

**Proceedings of the meeting
of the Advisory Board of
the Imperial Council of
Agricultural Research**

Held at New Delhi on the 12th, 13th, 14th,
15th and 16th January 1931

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Schedule of papers circulated to Members of the Advisory Board of the Imperial Council of Agricultural Research for its meeting held at New Delhi on the 12th, 13th, 14th, 15th and 16th January 1931.

Notes on subjects 1 to 18 and 20 to 35 of Agenda.

AGENDA FOR THE MEETING OF THE ADVISORY BOARD OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH TO BE HELD AT NEW DELHI FROM 12TH TO 18TH JANUARY 1931.

1. Decisions of the Governing Body on the recommendations of the Advisory Board in June 1930.
2. Expansion of Pusa as an educational centre.
3. Establishment of an enlarged Animal Nutrition Institute at Dehra Dun.
4. Rice Research :—
 - (a) Proposal for the establishment of a research station in the United Provinces.
 - (b) Rice physiology scheme prepared by Professor R. H. Dastur, Professor of Botany, Royal Institute of Science, Bombay.
5. Necessity for a Central Institute for Education and Research in Dairying in India.
6. Proceedings of the third meeting of the Sugar Committee held in August 1930.
7. Establishment of a sugarcane seedling testing station in Bengal.
8. Scheme for an economic enquiry into the cost of sugarcane production in the United Provinces, North Bihar, Bombay and the Punjab.
9. Scheme for a sugarcane research station in the Bombay Deccan.
10. Appointment of Veterinary Research Officers in the Provinces :—
 - (a) Scheme for research into the protection of buffaloes and cattle from Haemorrhagic Septicaemia by the Bacteriophage Method in Bengal.
 - (b) Application for a recurring lump sum grant for three years to cover the pay of a research officer and equipment to investigate the causes of contagious diseases in animals in the Central Provinces.
11. Proposals for (a) Investigations on virus diseases of plants, and (b) physiologic forms of wheat rust in Bombay.
12. Application from Dr. S. S. Bhatnagar for a grant of Rs. 3,000 a year, for two years, for research on the effect of different Ions on plant growth.
13. Application from Dr. S. S. Bhatnagar for a grant of Rs. 4,150 a year, for two years, for investigations on the relation between the physico-chemical properties and fertility of soils.
14. Scheme for the appointment of a Physical Assistant on the staff of the Agricultural Chemist, Bengal.
15. Application for a grant for experiments on manuring and marketing new types of barley.
16. (a) Establishment of Nutrition research sections in major provinces to work in collaboration with the proposed Nutrition Institute at Dehra Dun.
- (b) Appointment of a Physiological Chemist to study Animal Nutrition problems at Dacca.

17 Application from Dr. H. C. Chaudhuri for a grant of Rs 12,600 spread over three years for investigation of the "wither tip" of citrus trees.

18. Proposals for the establishment of a research station at Shillong for the development of Bee-keeping in India.

19.—Omitted.

20. Revised scheme of research in fruit growing in Madras.

21. Application from Dr A. E. Slater, Mission Poultry Farm, Etah, for a grant for 5 years for breeding experiments in connection with the improvement of goats.

22. Production of agricultural cinema films.

23. Testing of Indian agricultural products in England.

24. Application from the Government of Madras for a grant for research work on potatoes.

25. Participation of India in the International Dairy Congress, Copenhagen, 1931.

26. Representation from Kirlokar Bros., in regard to the rates of railway freight charged on agricultural implements.

27 Assistance to be given by the Indian Railway Central Publicity Bureau to promoting agricultural and veterinary development.

28. Dry-farming research station for the Bombay Deccan.

29. Research on the water requirements of crops.

30. Proceedings of the first meeting of the Fertilisers Committee held in June 1930.

31. Preliminary report on the calorific value of some Indian woods.

32. Arrangements for the examination by specialists of papers for publication in the new Journals and the preparation of a list of referees.

33 World's Grain Exhibition and Conference, Canada, 1932.

34. Revision of the Publications "Dictionary of the Economic Products of India" and "The Commercial Products of India".

35 Scheme for research on Plant Physiology at the Hind University, Benares.

PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD
OF THE IMPERIAL COUNCIL OF AGRICULTURAL RE-
SEARCH HELD AT NEW DELHI ON MONDAY, THE 12TH
JANUARY 1931.

The following were present :—

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, *Chairman*.
2. Major F. H. BRIDEN (attended in the afternoon).
3. Mr. B. C. BURT.
4. Mr. P. H. CARPENTER.
5. Mr. G. K. DEVADHAR.
6. Mr. R. S. FINLOW.
7. Dr. N. N. GANGULI.
8. Mr. K. HEWLETT.
9. Mr. G. R. HILSON.
10. Dr. L. K. HYDER (attended in the afternoon).
11. Mr. NIZAMUDDIN HYDER.
12. Dr. B. A. KIRK.
13. Mr. P. J. KIRK.
14. Mr. T. F. MAIN.
15. Mr. D. MILNE.
16. Colonel A. OLVER.
17. Mr. F. J. PLYMEN.
18. Mr. T. F. QUIRKE.
19. Mr. W. ROBERTSON-BROWN.
20. Mr. P. T. SAUNDERS.
21. Mr. R. L. SETHI.
22. Major R. I. STIRLING.
23. Mr. W. TAYLOR.

Mr. M. S. A. HYDARI, *Secretary*.

The following attended as visitors :—

1. Dr. S. P. AGHARKAR.
2. Mr. B. A. COLLINS (not present in the afternoon).
3. Dr. W. H. HARRISON.
4. Dr. W. McRAE.
5. Mr. W. SMITH.
6. Mr. F. J. WARTT.

2. The meeting lasted from 11 A.M. till 5 P.M. with an interval for
lunch from 1.30 P.M. to 3 P.M.

3. The Chairman, after welcoming members and visitors opened the discussion by referring to the note (Appendix I) of the decisions of the Governing Body made on the recommendation of the Advisory Board at its meeting in June 1930 which formed subject 1 of the agenda.

In regard to sub-paragraph 10 of the note (Appendix I) the Chairman explained that Sir Guy Marshall, and Professor Uvarov, with whom he had discussed the Empire Scheme of Locust Research, had informed him that the Empire Locust Research Scheme was due to start early in January. He had however subsequent information that owing to the fact that King Ibn Saud had vetoed the visit of any investigation party in Arabia, it would have to be confined to countries further west than Arabia. As it was with locust investigation in Arabia, with which India was principally concerned the locust research now being conducted under aegis of the Council would be separate from that carried on the African side of the Red Sea. There was, therefore, nothing for India to do but follow the course she was doing.

In regard to sub-paragraph 15 (Appendix I) the Chairman announced that while in London he had conferred with the Empire Marketing Board. The latter considered that expenditure on quarters should be met by the Provincial Governments concerned. With this exception the Board were sympathetic towards sharing the cost of the rice schemes. There was, however, another difficulty which was that the British Chancellor of Exchequer had warned the Board not to undertake new liabilities till the Chancellor had decided what grant to give them for the ensuing year. The Board could, therefore, take no final decision in the matter which was therefore still open.

4. *Expansion of Pusa as an educational centre (subject No. 2 of the agenda) (Appendix II).*—Dr. Keen in introducing the subject said that he would prefer the Directors of Agriculture present at the meeting to express their views first. He desired, however, to make a few preliminary remarks. The questions with which they were concerned were the provision of facilities at Pusa for the training of post graduate students and secondly for what might be called more formal courses of instruction for men of the Deputy Director of Agriculture type. Success in regard to both these points depended, in his opinion, upon the success which Pusa achieved as a centre of fundamental research. He was satisfied that this could be achieved in a relatively short period of time provided the necessary funds were available. Only second to the provision of adequate funds was the need for the presence of keen post-graduate students at Pusa if it was to become a really first class research institution. Post graduate students were the life blood of research institutions. He considered that though research work of a high quality was being done in the provinces there was need for a central institution which could tackle problems of long range research which were somewhat outside the ambit and the resources of Provincial Departments. Mr. Devadhar was not sure whether facilities which would be provided at Pusa would be utilised by Provincial Governments who, in his opinion, judging from the letters received from them in reply to the circular letter of the Government of India, No. 1215-Agri., dated the 23/27th July 1929 (Appendix II), did not appear to be very keen on this point. Mr. Burt said that Bombay was alone in saying that it did not require facilities in India outside those which it could provide within the Presidency itself; other local Governments on the contrary were as specific

and encouraging as the Government of India had a right to ~~expel~~ ^{expel} ~~the~~ ^{the} ~~proposal~~ ^{proposal} ~~to make~~ ^{to make} Pusa an all-India centre for post graduate training in agriculture said that as far back as 1922 a syllabus was framed and definite proposals made to establish Pusa as such, but that just then retrenchment came and the proposal was for the time being shelved. In these circumstances he considered that the guarded replies (Appendix II) of local Governments were natural. Mr. Milne was of opinion that although several Provincial Agricultural Colleges, for example, the Lyallpur College, had very good facilities for training in certain lines, a central institution like Pusa would be able to give training in special directions which Provincial Colleges could not give, but that from the very fact that facilities did exist at the latter the calls on the central institution would be few. He considered that a central institution should carry out fundamental research of an all-India character. He emphasized that research should be the first function of such an institute and training in research work there second. Mr. Plymen stated that all the provinces in India were re-organising their agricultural services. They were now recruiting for a Superior Provincial Agricultural Service which had replaced the Indian Agricultural Service. What they in the Central Provinces had laid down as a condition for entry into this Superior Service was training in agricultural science plus a two years training in a recognised institution. The question was as to the institution which would be so recognised. He considered that Pusa would be one such institution. He was not one of those who attached prime importance to the possession of local experience. In the Agricultural Department he wanted men with an open mind and he was strongly in favour of future recruits possessing wider experience than what a training in a Provincial Agricultural College would give. For this reason he was in favour of sending likely recruits to Pusa or abroad. He did not care whether lectures were or were not given at Pusa but what he did want Pusa to do was to give training in research work. Mr. Milne was in entire agreement with this. Mr. Finlow said that he would emphasize the point that the first function of a central Research Institute was the conduct of fundamental research of the highest standard and that post graduate training was ancillary to this. Whether an institution did or did not attract post graduate students today depended upon the calibre of research conducted there and he would therefore put forward as a first desideratum that Pusa should be a first class centre of research. Mr. Hilson while agreeing generally with Mr. Finlow said that there were certain advantages in spending a student abroad as against sending him to Pusa. Conditions at Pusa were somewhat similar to those in the rest of India and if a wider outlook, the necessity for which had been stressed by previous speakers, was desired it might be an advantage to send the students now and then abroad. These conditions were so wholly dissimilar to those in India that the mere shock of changed conditions and wider opportunities would help the student to acquire a wider outlook. Mr. Main said that he could not support a proposal to make Pusa the only institution in India at which post graduate instruction could be given in agriculture. If it was desired that it should be an institution where such instruction was given without excluding other possible institutions he did not mind. He reminded the Board that an institution which set out to give post graduate training must first make its reputation. He considered that while Pusa could give instruction of the highest

standard in certain branches of agriculture it could not give it in all, for example, in regard to cotton. He therefore thought that it should confine itself to two or three special subjects. Mr. Selhi was strongly in favour of Pusa giving post graduate instruction for which he considered it was better fitted than any Provincial Agricultural College. Mr. Collins was of the opinion that in view of the recommendations of the Royal Commission on Agriculture and of the establishment of the Imperial Council of Agricultural Research it was only logical that the Government of India should do its best to develop one or more Agricultural Research Institutions of the highest type. There should be one institute at least in India which would confine itself to fundamental research. If it did Provinces and Indian States would take the fullest advantage of it though naturally training abroad would also have to be occasionally resorted to. There was at the present time a feeling among students that if one obtained a foreign degree he stood a better chance of getting a post in the Agricultural Department. There was no reason why with a first class institution in India capable of giving instruction of the highest standard this feeling in regard to the superiority of foreign degrees should not disappear. Mr. Robertson-Brown said that the Centrally Administered Areas had only Pusa to look up to in regard to the training of their agricultural officers. Dr. Agharkar said that provinces were at the present moment in varying stages of development. Some Provincial Colleges like Lyallpur gave agricultural training up to the Master's degree; such would probably not have much need of Pusa. In others which were not so advanced the attraction towards Pusa would be stronger. He wished to point out further that Pusa was not very well situated for all kinds of research. He mentioned the utility of the Kaiser Wilhelm institutions in Germany; these were a number of institutions of different types each specialising in certain branches of science. Pusa in his opinion should be developed on such lines and could be made pre-eminent in those lines for which it was pre-eminently suited. Moreover, Pusa could only justify itself if it brought itself in closer contact with Indian Universities, for instance, if the post graduate training given there was of a standard which Universities would accept for the grant of Doctorates in Agriculture. If this result were achieved it would be able to attract students even though no promise of employment went with a successful conclusion of their course of training. In short, Pusa should be fitted in with other educational institutions in India. Mr. Carpenter said that as he saw it the position was this: Pusa was a research station for fundamental research. Provincial Institutions like his own, viz., the research station of the Indian Tea Association at Toeklai were stations for the conduct of applied research. He was at one with Mr. Finlow and others in insisting that the most important function of Pusa was that of a research station for fundamental research. Its expansion as an educational centre was secondary to this. He wanted to know what was meant by expansion. Was expansion of staff or expansion of space for students meant? If that was so the Board should have a syllabus and a scheme of work for post graduate training before it could discuss the question of expansion which might lead to an application for a grant from the Council. In his opinion if Pusa created a proper research atmosphere then instead of students from India having to go abroad it would probably be the case of students from abroad coming to India. He also felt that Pusa ought to specialise in certain subjects. That was his reason for enquiring as to the lines on which expansion was contemplated. He quite agreed that it was impos-

sible for local Governments to say from the start how many students they would send. That naturally depended on various factors which could not be foretold at present, one of which was as to how Pusa would shape. He also was somewhat doubtful whether in being asked to assent to the proposal under discussion the Advisory Board was being asked to recommend expenditure which would fall on the funds of the Council. If so, he thought that the Board should have details. In regard to the meeting of 1922 referred to by Mr. Burt he had looked at the minutes (Appendix III) but he felt that those attending the meeting did not know what they wanted. It seemed to him that the conclusions of that meeting were really formulated by the President without any reference to what the other members of the meeting had said. Dr. Ganguli agreed with Messrs. Agharkar and Carpenter in holding that Pusa should be developed as a centre of fundamental research but he felt that to achieve that end it would have to take in a number of post-graduate students which, quoting Dr. Keen, he said were the life blood of any research institution. At this stage Mr. Devadhar intervened and moved the following resolution which was seconded by Mr. Main.

"In view of the developments made by the various Provincial Governments in the direction of agricultural education and agricultural research, this Board is of opinion that the question be postponed and referred to a sub-committee to estimate the cost and work out a detailed scheme."

Thereupon a second resolution was moved by Mr. Finlow and seconded by Mr. Carpenter.

"That Pusa should continue to be developed actively and to the greatest possible extent as an Institute for fundamental research. If facilities for post-graduate training analogous to those provided at present are then offered, it will attract research students in proportion to its success as a research centre."

Before putting the two resolutions to the vote the Chairman asked Dr. Keen whether he would like to say anything in the light of the previous discussion. Dr. Keen said that on the whole he considered that the provincial directors were distinctly sympathetic to having a centre in this country where fundamental research was carried on. He confessed that had he been a Director of Agriculture he would have spoken very much in the same vein as the Directors of Agriculture present at the meeting had spoken, namely, that as to whether they were or were not prepared to send their men to an institution depended upon the institution itself. What was required was the removal of difficulties in the way of further advance and the increase of facilities for such advance. In regard to the suggestion made by Bombay that if need be they could always send students for training abroad he would like to point out that it was getting increasingly difficult to obtain admission for students in foreign institutions of the required standard. He was all for having in one's own country an alternative institution. He was in complete sympathy with Dr. Agharkar's view that Pusa should be brought into the closest possible touch with Indian Universities through, for example, the post graduate course of training which would be given there being recognised as sufficient for a Doctorate of Agriculture in an Indian University. Finally, he would lay down no rigid rules or regulations for the conduct of post graduate training at Pusa. The whole essence of such training was that it should be fluid

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and flexible to suit the circumstances of each case. The less rules there were the better. It was only thus that the training could be adapted to the needs of each particular student.

Mr. Devadhar's resolution noted above was then put to the vote and lost. Thereupon Mr. Finlow's resolution which was seconded by Mr. Carpenter and which ran as follows was put to the vote and carried unanimously :—

“ That Pusa should continue to be developed actively and to the greatest possible extent as an Institute for fundamental research. If facilities for post-graduate training analogous to those provided at present are then offered, it will attract research students in proportion to its success as a research centre.”

5. The Chairman considered that the general discussion which had taken place so far would be of the greatest assistance to the Government of India but he felt that the stage had now been reached at which the Board should give definite answers to the four questions asked in the letter of the Government of India, No. 1826-Agri., dated the 6th September 1930 (Appendix II.)

Question 1.—Is definite post graduate instruction, as distinct from facilities for research work, desired in all the subjects dealt with at the Pusa Research Institute ?

The Board agreed to a resolution moved by Mr. Burt and seconded by Mr. Milson that :—

“ The provision of facilities for research work and for acquiring a knowledge of modern research methods and technique is all important : this involves a certain amount of definite but not formal instruction.”

Before the discussion on this point was closed Mr. Burt said that he wished to draw attention to a point made on a previous occasion by the Imperial Entomologist as to the need for a more formal training in Entomology for University graduates taking up Entomology. This was probably necessary in view of the fact that there were not adequate facilities for Entomological training in Indian Universities. Dr. Keen replied that it was to provide for such cases amongst others that he had pleaded that the regulations for post graduate training at Pusa should be as fluid and flexible as possible. He would arrange for a formal course in respect of particular students, if necessary, but would prefer not to be bound down by regulations or resolutions. It was quite likely that post-graduate workers in entomology or mycology or physiology would have to spend a longer time than those taking at other branches of science but it was the function of an institution which gave post-graduate training to adapt the latter to the varied needs of various students.

Question 2.—Is there a need for a special post-graduate course at Pusa designed for future Assistant and Deputy Directors of Agriculture, as distinct from the specialist courses in special branches of agricultural science ? If so, should the special course for Assistant and Deputy Directors be largely in the nature of a refresher course in science and in the technique and interpretation of field experiments designed for men

whose initial training has been largely in agricultural colleges and who have had considerable subsequent experience in practical agriculture ?

There was general agreement that there was need for such a course and also that it should be an original course. Messrs. Main and Burt, while agreeing to the latter, pointed out that in some cases it would be desirable to give a refresher course in the various branches of agricultural science ; in order to assist students coming from a Provincial Department of Agriculture who had left the University or the Agricultural College several years before and were not acquainted with the recent advances in pure science.

Question 3.—What will be the general standard of scientific and technical knowledge which candidates recommended by Provincial Departments of Agriculture will have attained prior to entering on their post-graduate course ?

Mr. Milne said that in the Punjab Department of Agriculture while they did recruit men with a purely scientific training for special appointments the majority of men selected for his Department were those who were B.Sc.'s in Agriculture. Mr. Plymen was against prescribing any scientific qualifications in regard to men sent from a Provincial Department of Agriculture to Pusa. He would leave the recommendation to the discretion of the Director of Agriculture. Mr. Finlow said that he would make a difference as between a post-graduate course for purely scientific men and the special course for Assistant and Deputy Directors of Agriculture. For the former he would insist on very high scientific qualifications ; for the latter lower scientific qualifications might suffice. Mr. Main considered that they should not be satisfied merely with a degree, however excellent that may be, but should also insist that the men sent for post-graduate training had previous experience. Mr. Hilson agreed with Mr. Main. Dr. Agharkar said that the admission of students should not be dependent upon the recommendations of Directors of Agriculture. It was for Pusa like other research institutions in the world to lay down the minimum qualifications which it would require for entry to a post-graduate course there. If a student had those he would be eligible for admission. As to what such minimum qualifications should be Dr. Agharkar thought that this question should be investigated by a small committee. Mr. Carpenter agreed with Dr. Agharkar. Generally speaking he would put down the minimum qualifications as at least an M. Sc. degree. On the question of qualifications Mr. Burt proposed :—

That for University students seeking admission to the post-graduate course it should be insisted that ordinarily they should have the highest degree in science, short of a Doctor's degree awarded by the University from which they came and that for agricultural graduates a first class or a high position in the College gradation list should be demanded.

This proposal was accepted.

Question 1.—The class of students which should be admitted to the Pusa Research Institute for post-graduate training ?

It was generally agreed that entry to the post-graduate course should not be confined to men already in Government service but should be open to private students. That in each province there should be a selection committee on which due representation should be given to Universi-

ties and that the recommendations of such selection committees should go before a selection committee at Pusa. It was generally agreed that as pointed out by Dr Keen an institute should have the final voice in the selection of students which it admitted. It was also agreed that the formation of such provincial selection committees should not debar the authorities at Pusa from admitting a student who had not gone before a provincial selection committee but who in the former's opinion was suitable for taking up the post-graduate course. In regard to qualifications it was agreed that ordinarily candidates should not be selected unless they had the highest degree in science short of a Doctor's degree which the University from which they came awarded.

Mr Devadhar inquired if the course to be framed would be submitted to the Advisory Board of this Council for their criticism and added that in his opinion the training to be provided for the Post-Graduate Course laid down for the Assistant and Deputy Directors of Agriculture of the various provinces should contain among others a paper on :—

- (a) Agricultural Economics.
- (b) Agricultural Co operation.
- (c) Popular methods of propaganda so as to make these officers the best links between the experts on the one hand and the cultivators on the other.

6. The Chairman then referred the Board to paragraph 6 of the Government of India's letter referred to above drawing the attention of the Imperial Council of Agricultural Research to the recommendations of the Royal Commission on Agriculture in connection with the formulation of a scheme for research scholarships and also for scholarships for post-graduate training for district work. Mr Burt in opening the discussion referred to the proceedings of the Conference of Ministers of Agriculture held in 1928 which expressed itself to be against any scheme of pooling provincial and central resources towards the financing of a general scholarship scheme. The Board must therefore proceed on the understanding that money for any scheme of scholarships recommended by the latter would have to be found from the funds of the Research Council. Continuing Mr. Burt said that he could think of two kinds of scholarships for work in India and a third for work abroad, viz.,

- (1) To enable suitable graduates to take a post-graduate course at Pusa. This would be a very limited number.
- (2) Continuation scholarships, rather on the lines of research fellowships which would assist men of proved capacity as research workers to continue research work at some established institution who but for such monetary assistance would not be able to do so.
- (3) If scholarships for study abroad were given by the Council at all they should be awarded to really distinguished men from India who could do research of a high order abroad.

A good many members of the Board referred to the difficulty in providing employment for scholars after the termination of their scholarships. Professor Ganguli explained the system of scholarships awarded by the Ministry of Agriculture in England, funds being made available from the Development Commission and said that they should not be obsessed too much with the problem of appointments.

Scholarships should be given for definite problems related to some scheme of research of which he has a few examples. Mr. Carpenter threw out the suggestion that they might follow the example of the Colonial Office in Great Britain. That Department gave scholarships to particularly brilliant students to do a certain line of research and at the same time keep them going till a suitable post had been found for them. Colonel Olver said that on the animal husbandry side what they lacked was suitable men; scholarships might provide a reservoir of such men from whom a selection could be made. Dr. Keen said that while Pusa was concerned equally with other institutions in India in such a scheme for scholarships he would appeal that the question be looked at from a point of view other than the purely commercial. The object of such scholarships should not, in his opinion, be merely with a view to provide the scholar at the end of his time with a job, but rather the promotion of research. He would ask for a little courage both on the part of the Imperial Council as well as of the scholar. It was quite likely that a particular piece of research might result in the creation of lucrative appointments. For example, the problem of cold storage to which Dr. Ganguli made a reference might conceivably after due investigation result in producing new openings for technical men. The Chairman said that no reply was due to the Government of India on this subject; the latter had merely drawn the Board's attention to it with a view to such action as the Imperial Council might care to take on the recommendations of the Royal Commission. The discussion had been a very useful one and he personally shared Dr. Keen's views on the subject. For the present, however, and until a definite scheme had been worked out the Board might take note of the subject and pass on to the consideration of the next one.

7. *Establishment of an enlarged Animal Nutrition Institute at Dehra Dun, (subject No. 3 of the agenda). (Appendix IV).—*After Mr. Warth and Colonel Olver had briefly introduced the subject Professor Ganguli enquired whether the Council was being asked to find any money towards this scheme. He was informed that at this stage no demand for a grant was being made but that the views only of the Advisory Board had been asked for as to the utility or otherwise of this scheme. Professor Ganguli then proceeded to ask why Dehra Dun had been chosen as the site for the proposed institute; whether the fact that buildings and land were available at Dehra Dun rather than the suitability of Dehra Dun for the location of such an institute was not the prime cause of Dehra Dun being selected. Why, for example, was it proposed to shift from Bangalore? At this stage the Chairman adjourned the meeting till 11 A.M. on the 13th.

M. S. A. HYDARI,

Secretary.

The 12th January 1931.

PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD
OF THE IMPERIAL COUNCIL OF AGRICULTURAL RE-
SEARCH HELD AT NEW DELHI ON TUESDAY, THE 13TH
JANUARY 1931.

The following were present :—

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, *Chairman*.
2. Mr. B. C. BURT.
3. Mr. P. H. CARPENTER.
4. Mr. G. K. DEVADHAR.
5. Mr. R. S. FINLOW.
6. Dr. N. N. GANGULI.
7. Mr. K. HEWLETT.
8. Mr. G. R. HILSON.
9. Dr. L. K. HYDER.
10. Mr. NIZAMUDDIN HYDER.
11. Dr. B. A. KIEN.
12. Mr. P. J. KERR.
13. Mr. T. F. MAIN.
14. Mr. D. MILNE.
15. Colonel A. OLVER.
16. Mr. F. J. PLYMEN.
17. Mr. T. P. QUINN.
18. Mr. W. ROBERTSON-BROWN.
19. Mr. P. T. SAUNDERS.
20. Mr. R. L. SETHI.
21. Major R. F. STIRLING.
22. Mr. W. TAYLOR.

Mr. M. S. A. HYDARI, *Secretary*.

The following attended as visitors :—

1. Dr. S. P. ACHARKAR.
2. Mr. B. A. COLLINS.
3. Dr. W. H. HARRISON.
4. Dr. W. McRAE.
5. Mr. W. SMITH.
6. Mr. F. J. WARTH.

2. The meeting lasted from 11 A.M. till 5 P.M. with an interval for lunch from 1-15 P.M. to 3 P.M.

3. Subject No. 3 (Appendix IV) continued. Colonel Olver replying to Professor Ganguli said that it was not because suitable buildings were

available at Dehra Dun that the latter place was selected ; when it was found that there was no possibility of expansion at Bangalore a scheme for the location of the Institute at Dehra Dun had been drawn up which provided for buildings and was estimated to cost about 8 lakhs. It was only recently that buildings which were very well suited for a Nutrition Institute had become available owing to the closing of the X-Ray Institute. He thought that the essentials for a research institution of the kind proposed were, first that it should be reasonably easy of access ; secondly, that it must be healthy for stock ; and lastly, that it should be suitable for work all the year round. Dehra Dun satisfied all these conditions and had moreover other research institutions located there like the Forest Research Institute. This would be an added advantage. It was desirable that scientific men should have opportunities of meeting together and comparing notes. The Forest Research Institute especially could help the Nutrition Institute greatly in questions relating to the use of forest products as fodder. Further, the use of rice straw as fodder which was an important question in India could be very well investigated at Dehra Dun where very good rice land was available. Izatnagar, Hissar and Karnal were within easy reach so that there would be no difficulty in keeping the Institute supplied with stock. Animal health was another very important consideration. The land which he had selected at Dehra Dun was well drained and his exhaustive enquiries in regard to the condition of stock in the Dehra Dun area had convinced him that it was a very healthy locality for stock. In this connection he drew attention to the fact that the Body Guard kept their horses at Dehra Dun for long periods of the year. He had originally selected a piece of land which would have had to be purchased but on a second visit he had come across a piece of Government land about 325 acres in extent adjoining the X-Ray Research Institute which would serve the purpose very well. Dehra Dun had been selected as a suitable site for the Animal Nutrition Institute by Dr. Clouston, Dr. McRae, Mr. Burt and Mr. Smith before he himself arrived and after enquiry he came to the same conclusion. Dr. Hyder said that he strongly supported the proposal. In his opinion two-fifths of the misery in India arises through the loss of cattle. There was however one matter to which he should like to draw attention. He did not approve of the proposed Animal Nutrition Institute being under any other authority such as Pusa or Muktesar. It was impossible to direct an institution from a distance. Such an arrangement was merely bureaucratic. What he urged was that if as he hoped an Animal Nutrition Institute was started at Dehra Dun it would be given an independent status and the small allowance asked for the Director would not be grudged. Mr. Sethi said that experiments should be conducted in the plains and that research stations should be in the plains. Dehra Dun was exceptional and not typical of the rest of India. Further he thought that an Animal Nutrition Institute should be close to a veterinary college. Mr. Warth replying to the criticism that conditions at Dehra Dun in the matter of fodder were not typical said that even at Bangalore they had tested materials coming from as far away as northern Punjab. Mr. Kerr said that in Bengal their problem was the utilisation of numbers of indigenous plants as fodder. Bengal was going to have a bio-chemist who would work in collaboration with the proposed Central Institute which he thought was absolutely necessary. There need be, in his opinion, no fear that there would be difficulty in applying the results obtained at the Central Institute in the provinces with their varying climatic and other

conditions ; for it would be the duty of provincial stations to adapt results obtained at the Central Institute to their own needs. Mr. Quirkie said that Dehra Dun would be very suitable for the Punjab where they were hoping to start a sub-station which would work in collaboration with the Nutrition Institute. Mr. Saunders said that in Madras the ignorance about cattle food was abysmal. People fed their cattle with the same kind of stuff as their fathers and grandfathers had fed them with before them. In Madras there was the practice of cattle migrating in the summer in search of food. This was uneconomical and was a potent cause of the spread of disease. If therefore as a result of research what was found in a place could be utilised as fodder for the cattle of the place it would be a great saving economically and in other respects. Mr. Hewlett was against the Animal Nutrition Institute being near a veterinary college as the latter was situated in towns. Replying to Mr. Devadhar Colonel Olver informed him that it was not proposed to shift the Dairy Institute from Bangalore ; there was no particular reason why dairying and animal nutrition should go together. Major Stirling also supported the scheme. Professor Ganguli was in entire agreement as to the necessity for an Animal Nutrition Research Institute. The only question about which he was not satisfied was its proposed location at Dehra Dun. When the Nutrition Section was started at Dehra Dun the then experts probably considered it quite suitable. So did experts consider Burma as suitable for cinchona plantation though it was found later that cinchona would not grow there. When the Royal Commission on Agriculture visited Bangalore they felt that there was not sufficient space there but the suitability of the place itself was never questioned. He was of opinion that the question of location of the proposed Institute should be dealt with by a special committee of the Council. Mr. Warth replying to Professor Ganguli said that Bangalore was not the choice of any expert. It was chosen for him. After two years he knew that Bangalore would not do because of lack of room for expansion. He would point out that hardly any money had been spent on buildings and what few buildings there were for the Animal Nutrition Section would be very welcome to the Imperial Dairy Expert, Mr. Smith, whose section also was in great need of expansion. He confirmed what Colonel Olver had said that Dehra Dun was not selected because the buildings were there but long before they had any knowledge that buildings would become available. His first plans had provided for erection of new buildings. Professor Agharkar did not agree that the existence of educational and research institutions at Dehra Dun was an argument in favour of locating the Animal Nutrition Institute also there ; for, the kind of research conducted at the former bore no relation to the research which would be done at the latter. Animal nutrition work was akin to the work on human nutrition which was being done by Colonel McCarrison at Coonoor. Mr. Carpenter said that he was at first somewhat bothered about the wastage of buildings at Bangalore but in view of Mr. Warth's explanation that they would be fully utilised by the Dairying Section, this obstacle no longer existed. He confirmed what Mr. Warth had stated that Bangalore was never chosen as being the best centre in India. It was chosen purely as a matter of convenience. Then as pointed out by Colonel Olver Dehra Dun had been selected not by one expert but by several. He therefore would support the proposal to have the Institute at Dehra Dun. He also supported Dr. Hyder's point that the Institute should have an independent status.

In reply to the Chairman Mr. Smith said that there was no possibility of acquiring more land in Bangalore ; land round about the Dairy Research Institute in which the Animal Nutrition section was also located was Mysore territory ; it was cultivated and held under a tenure which precluded its acquisition by the Mysore Government for the Dairy Research Institute without the consent of the owners of the land. This was not forthcoming. He needed all the space available for his own work of dairy research whereas now he had to share it with the nutrition section. In the result it detracted from the work of both. Cattle which had been made the subject of fodder experiments, could not be expected to yield milk to their full capacity. Further the limited land available for growing crops was not sufficient to allow for the needs of the Nutrition Section for which it was necessary to grow special crops. He would be fully able to utilise the space left vacant by the transfer of the Nutrition Section to the betterment of the work of dairy research at Bangalore. He could not conceive of a better place for the location of Nutrition Institute than Dehra Dun. He had examined Belgaum and Jubbulpore but they were not so suitable. Dehra Dun had the great advantage that it grew almost every variety of crop. In the hot weather it was much hotter than Bangalore and in the cold weather it was much colder than Bangalore. In the result both tropical and temperate crops could be grown at Dehra Dun.

The Board agreed to the necessity for the establishment of an enlarged Animal Nutrition Institute in India and for its location at Dehra Dun. The fact was also noted that at present the Council was not committed to the grant of any money.

4. *Subject No. 4—Rice Research.*—(a) Proposal for the establishment of a research station in the United Provinces (Appendix V).—After Mr. Sethi had explained the scheme (Appendix V), Mr. Burt in reply to Professor Ganguli said that the scheme fitted in with the co-ordinated scheme of rice research which had already been approved in principle by the Council. The position in regard to the share of the Empire Marketing Board in schemes of rice research was at present uncertain as had been explained by the Chairman at the meeting of the 12th. Mr. Burt, however, drew attention to the fact that on one point the Empire Marketing Board were quite definite, namely, that they would not share in any expenditure on residential quarters which in the Board's opinion should be borne by each Province. Mr. Burt supported the scheme but not its financial details especially in view of the criticism of the Empire Marketing Board in regard to residential accommodation. He explained that the Board's objection did not extend to all capital expenditure, for example, on laboratories. Mr. Sethi informed Mr. Devadhar that the United Provinces would continue to spend Rs. 30,000 per annum on rice research as they had been doing for the past 4 or 5 years. Messrs. Hilson and Plymen criticised the provision proposed (Appendix V) for the pay of staff, running charges, laboratory, tube well and gas plant as excessive. Professor Agharkar drew attention to the point that no mention had been made of receipts from the land which ought to be considerable. The Chairman considered that to ask the Council to provide for the cost of an Inspection Bungalow (Appendix V) was not right. Dr. Hyder and Mr. Carpenter both urged that the principles governing grants which had been laid down by the Governing Body of the Council should not be departed

from at the request of an applicant. If that were done and the Council on the plea of financial stringency made exceptions the result would be that in course of time the Council would have to do everything and Provincial Governments nothing. Mr. Carpenter also said that looking at the rice schemes so far approved they were only concerned with one side of rice research, namely, the genetic. There were other sides also and he thought that a technical committee should examine the present scheme and pronounce a definite opinion thereon. The Chairman considered that as the scheme under discussion had been subjected to criticism from several points of view it might be examined by the same committee as examined the previous rice research schemes. This would be preferable to referring the scheme back to the local Government and thus delaying a decision thereon. As a few members of the original rice committee were not present at this meeting others were nominated in their place and a sub-committee composed of the following was appointed with instruction to report to the Board before the conclusion of the present meeting :—

1. Mr. B. C. BURT.
2. Mr. P. H. CARPENTER.
3. Mr. R. S. FINLOW.
4. Dr. N. N. GANGULI.
5. Mr. G. R. HILSON.
6. Dr. B. A. KELN.
7. Mr. T. F. MAIN.
8. Mr. F. J. PLYMEN.
9. Mr. R. L. SETHI.

with the Chairman and Secretary of the Board as *ex-officio* Chairman and Secretary of the sub-committee.

5. *Subject No. 4—Rice Research.*—(b) Rice physiology scheme prepared by Professor R. H. Dastur, Professor of Botany, Royal Institute of Science, Bombay (Appendix VI).—Mr. Main in presenting the scheme said that it was not a departmental scheme but one which had been put forward by the Bombay University in pursuance of the recommendations of the Royal Commission that Universities should be encouraged to collaborate in agricultural research. Mr. Burt said that Professor Dastur was working on a problem which had a definite practical importance, *viz.*, the nutrition of the rice plant. The amount of the grant applied for was reasonable and he supported the scheme, as did Professor Ganguli. Mr. Plymen said that during the Science Congress he and others had been very favourably impressed with the work already done by Professor Dastur and he strongly supported the present scheme. Professor Dastur was, however, labouring under one disadvantage in that he had no land for field work but had to grow what he wanted for his experiments in pots or in culture solutions. He thought that facilities should be provided for Professor Dastur for field work. Mr. Main undertook to do so at Karjat where the Bombay Government had a rice station if Professor Dastur applied for assistance. Dr. Agharkar also supported the scheme.

The Board approved the scheme with the rider that Professor Dasgupta should be asked to consider the advisability of asking the Bombay Department of Agriculture to grant him facilities at Karjat.

6. *Necessity for a Central Institute for Education and Research in Dairying in India (subject No. 5 of the agenda) (Appendix VII).*—After Mr. Smith and Colonel Olver had introduced the subject by explaining and emphasizing the need for a Central Institute for education and research in dairying in India and therefore for the maintenance and development of the existing Imperial Institute of Dairying at Bangalore, Dr. Agbarkar said that a research institute in India should conduct research in those dairy products which were indigenous to this country, for example, sour milk, ghee and butter. Cheese did not form part of the ordinary Indian diet and there was no use in a Dairy Research Institute in India applying itself for example to the problem of cheese manufacture. Therefore while there could be no two opinions about the need for such an Institute as existed at Bangalore he thought it should be emphasized that it should cater for the needs of the people; before undertaking any piece of research it should be ascertained whether that research however valuable it might be as a piece of research work was really suited to the needs of the country and also whether the results therefrom would redound to its economic good. Mr. Devadhar ascribed the lack of an adequate and pure milk supply in India to the lack of education among the milk producers. He commended the statement appearing in the Punjab Government's letter in reply to the circular letter of the Government of India to local Governments on education and research in dairying which ran as follows:—

“ There is reason to believe that a short vernacular course lasting about 6 months in practical dairying would prove more popular than a two-years diploma course. Youths, who have been educated up to the Middle Standard could there be given a useful and practical course in cattle management, feeding, and dairying, and would prove of value to large cattle owners and dairy men ” (Appendix VII).

Professor Ganguli referred to the statement in the letter from the Government of the United Provinces (Appendix VII) in regard to the Allahabad Agricultural Institute which gave dairy instruction of a high standard but which had not for the present been able to affiliate itself to any University and enquired whether the Board could not approach the Allahabad University on behalf of the Institute. Dr. Hyder said that the Board could not interfere in a matter of this kind which was entirely one for the University. Speaking on the main proposition he doubted whether there could be in India a Central Institute for fundamental research in dairying. If not, and he thought there was no scope for it, then the finance of what he would call a dairy factory school did not come within the purview of the Research Council's activities. Mr. Burt said that there was no question of providing any new institute. The institute already existed at Bangalore. In his opinion not only was that doing very valuable work and needed development but in a big country like India he thought there was room for more than one such Central Institution where dairy research could be carried on. He agreed, however, with Dr. Agbarkar that such an institute should adapt its research work to Indian conditions. On the other hand there was, for example, in Gujarat, an

indigenous dairy industry run more or less on modern lines and which had the same problem to tackle as dairy industries in countries other than India, for example, the economic disposal of skim milk. He suggested that the answer of the Board to the Government of India's letter (Appendix VII) should be that there was great scope for one or two central institutes for education and research in dairying. Mr. Milne referring to Mr. Devadhar's quotation from the letter of the Punjab Government said that the vernacular class recommended therein had already been started in the Punjab and that there were eight students in it. There was, however, in his opinion need for some central institute to tackle the bigger questions like the supply of milk to towns—in short the problems of the dairy factory industry. He as well as Messrs. Warth and Quirke paid tribute to the assistance they had received from the Imperial Dairy Institute, Bangalore, and from Mr. Smith. In Mr. Quirke's opinion the provinces should confine themselves to the elementary forms of dairy training, the higher forms being given by one or more central institutions. At this stage, Mr. Devadhar moved the following resolution :—

“ That having regard to the views expressed by the various Provincial Governments and to the suggestions made by the Government of the Punjab this Board would recommend to the Government of India as a useful preliminary measure in furnishing higher education in dairying to make funds available to local Governments on the basis of equal contribution for the establishment of scholarships for youths particularly of the Gowala class and for the establishment of a small course of six months for the study of subjects dealing with the industry of milk and its development by small men, or co-operative societies ”.

Dr. Hyder supported this resolution.

The Chairman put the resolution to the Board in two parts. The first part in regard to the Board recommending that a money grant on a fifty-fifty basis should be made by the Government of India was lost. The second part regarding the provision of short vernacular elementary courses in dairying in each province was passed. The Board also agreed to reply to the Government of India that there was great scope for one or two Central Institutes for education and research in dairying.

7. *Proceedings of the third meeting of the Sugar Committee held in August 1930 (subject No. 6 of the agenda) (Appendix VIII).*—These were noted.

8. *Establishment of a sugarcane seedling testing station in Bengal (subject No. 7 of the agenda) (Appendix IX).*—After Mr. Finlow had briefly explained the scheme Mr. Burt said that the proposal was recommended by the Sugar Committee. It formed part of the Committee's general scheme for a chain of sugarcane testing stations for the main sugarcane belt in Northern India. In his opinion, the importance of testing and propagating new varieties of cane could hardly be overestimated. During the last 5 years Java had replaced the whole of its canes by a new variety even though the canes previously grown were highly productive. The result of this replacement was that production had been increased greatly beyond what five years ago would have been thought possible. Mr. Hilson said that the Madras Government had established

and were maintaining a sugarcane station at Anakapalle out of their own resources and he would require whether the Council would help with funds to extend that station. He was informed by the Chairman that this was a matter for Madras. If the Provincial Government submitted a scheme of sugarcane research it would in due course be placed before the Sugar Committee.

The Board agreed to recommend the scheme for the favourable consideration of the Governing Body.

9. *Scheme for an economic enquiry into the cost of sugarcane production in the United Provinces, North Bihar, Bombay and the Punjab (subject No. 8 of the agenda) (Appendix X).*—Mr. Burt introduced the proposal which Mr. Finlow supported. In the latter's opinion it was very necessary to know the cost of production of various crops. In Bengal, for instance, during the last six months owing to the slump in the price of jute it had become of importance to compare the cost of production of jute with that of sugarcane and other alternative crops. Such data relating to cost of production for various crops would be of very great value. Mr. Milne said that they in the Punjab were starting a sugar factory and were very anxious to know the cost of sugarcane production. He would in the Punjab divide the enquiry not into irrigated and non-irrigated tracts but take one representative area in the South East Punjab and one in the Canal Colonies. The Chairman referred Mr. Milne to the proceedings of the Sugar Committee which had recommended that the actual tracts for enquiry would be decided upon later in consultation with Directors of Agriculture; it would be in co-operation with and on the advice of Directors of Agriculture that the enquiry would proceed. Mr. Robertson-Brown was against a costly investigation. He had in his own province not found any difficulty in finding out the cost of production and he thought that any intelligent agricultural man should have no difficulty in this matter. Mr. Hilson asked why Madras had been omitted from the scope of this enquiry. Mr. Burt replied that that was so because the Madras Government had informed the Government of India that they saw no possibility of an expansion of sugarcane in the Madras Presidency. Mr. Hilson said that the results of such an economic enquiry if conducted in Madras might help in extending the area under sugarcane in Madras, where it was desirable to limit the extension of paddy cultivation by encouraging the cultivation of alternative crops of which sugarcane was one of the most important. In reply to Dr. Agharkar the Chairman said that the man who would be chosen as the Economist who would direct the scheme would probably be recruited from among the ranks of Indian University Professors. Mr. Milne suggested that the questionnaire for the enquiry should be drawn up by a small committee. The success of the enquiry depended, in his opinion, on the comprehensiveness of the questionnaire. The success of the economic enquiries conducted in the Punjab by the Board of Economic Enquiry was very largely due to the excellence of their questionnaire. The Chairman agreed that a committee should go into this matter but after the Principal Economist had been appointed. Mr. Carpenter in supporting the scheme said that the method adopted whereby the whole scheme would be under the direction of one man, who would direct and co-ordinate the work of the various parties in the provinces was, in his opinion, the right way to work all-India schemes financed by the Council.

The Board agreed to recommend the scheme for sanction of funds by the Governing Body.

10. *Sugarcane research scheme for the Bombay Deccan (subject No. 9 of the agenda) (Appendix XI).*—Mr. Main in introducing the scheme drew the attention of the Board to the detailed statement of the case which had already been circulated to the Board. Mr. Burt said that this was undoubtedly an expensive scheme but the Sugar Committee after consultation with which this scheme had been prepared by Mr. Main considered that it was no use tinkering with the problem of sugarcane in the Bombay Deccan. Mr. Burt also drew the attention of the Board to paragraphs 2 and 3 of the note (Appendix XI) circulated to the Advisory Board in connection with this scheme which showed that allowing for the contribution of the Bombay Agricultural Department and for receipts from the cultivation of 100 acres of land the net cost of the scheme if sanctioned by the Council would be reduced to Rs. 2,76,238 over a five year period. This, in his opinion, was a reasonable figure and the expenditure proposed was justified by the importance of the scheme to Deccan agriculture as a whole. Mr. Main said that in forwarding the scheme (Appendix XI) to the Imperial Council of Agricultural Research his Government had said that it was prepared to enter into negotiations about its contribution to the Scheme, and hence he thought this particular point about receipts might fairly be made the subject of negotiations with the Bombay Government as he considered the suggestion of Mr. Burt reasonable. Mr. Robertson-Brown opposed the scheme as he thought that this was a provincial matter. Mr. Plymen said that information in regard to the effect of irrigation on black cotton soil which would be investigated under this scheme was of more than provincial importance, a statement with which Mr. Hilson in supporting the scheme also agreed. Mr. Plymen remarked that the question of crediting receipts accruing from a piece of work financed by the Council had never before been raised until this meeting. He thought that in future it should be. In regard to the Rs. 11,070 provided for residential quarters the Board considered that as the amount was small in relation to the total expenditure and as the local Government would in any case be making a contribution towards the cost of the scheme it was not worth while insisting in this case that the cost of these quarters should be borne by the local Government. Mr. Sethi proposed that the scheme be referred to a sub-committee for the examination of details. This was not accepted by the Board which recommended the scheme for the favourable consideration of the Governing Body.

M. S. A. HYDARI,

Secretary.

The 15th January 1931.

PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD
OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH
HELD AT NEW DELHI ON WEDNESDAY, THE 14TH
JANUARY 1931.

The following were present :—

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, *Chairman*.
2. Mr. B. C. BURT.
3. Mr. P. H. CARPLINTER.
4. Mr. G. K. DEVADHAR.
5. Mr. R. S. FINLOW.
6. Dr. N. N. GANGULI.
7. Mr. K. HEWLETT.
8. Mr. G. R. HILSON.
9. Dr. I. K. HYDER.
10. Mr. NIZAMUDDIN HYDER.
11. Dr. B. A. KEEN.
12. Mr. P. J. KERR.
13. Mr. T. F. MAIN.
14. Mr. D. MILNE.
15. Colonel A. OLVER.
16. Mr. F. J. PLYMEN.
17. Mr. T. F. QUIRK.
18. Mr. W. ROBERTSON-BROWN.
19. Mr. P. T. SAUNDERS.
20. Mr. R. L. SETHI.
21. Major R. F. STIRLING.
22. Mr. W. TAYLOR.

Mr. M. S. A. HYDARI, *Secretary*.

The following attended as visitors :—

1. Dr. S. P. AGHARKAR.
2. Mr. B. A. COLLINS.
3. Dr. W. H. HARRISON.
4. Dr. W. McRAE.
5. Dr. K. C. MISHRA.
6. Mr. F. J. WARTH.

2. The meeting lasted from 11 A.M. till 1.45 P.M. when the Board adjourned till the 15th at 11 A.M. to allow the sub-committee on the rice research scheme from United Provinces meeting and reporting in the interval.

3. *Appointment of Veterinary Research Officers in the Provinces.*—(Appendix XII).—(a) Scheme for research into the protection of buffaloes and cattle from Haemorrhagic Septicemia by the Bacteriophage Method in Bengal. (Appendix XII).

(b) Application for a recurring lump sum grant for three years to cover the pay of a research officer and equipment to investigate the causes of contagious diseases in animals in the Central Provinces.

(Subject No. 10 of the agenda). (Appendix XII).

Colonel Oliver in introducing the subject said that after a prolonged survey of the position in India he had come to the conclusion that instead of financing isolated schemes of veterinary research in the provinces two of which, one from Bengal and one from the Central Provinces, were already before the Advisory Board it would be better to organise disease investigation sections in the provinces concentrating pure research at Muktesar. He had accordingly drawn up a scheme (Appendix XII) for the appointment of veterinary investigation officers in certain provinces where they were most needed and which he submitted the Board should consider in substitution of the schemes from Bengal and the Central Provinces. Mr. Kerr said that he supported the scheme and agreed to the merging of the Bengal proposal in the "All India" Scheme, but urged that this should not delay an early start being made by deputing an investigation officer to Bengal.

It was likely that they would be in a position to offer facilities for the work in Bengal as there was a well equipped laboratory in the Veterinary College which was not being fully utilised for want of a research officer. Dr. Hyder while supporting Colonel Oliver's scheme pleaded for its extension to the North-West provinces and Baluchistan. As he understood it the object of the scheme was a systematic collection of facts about veterinary disease. In his opinion it was through the North-West Frontier of India that a good many of the veterinary diseases which infected the country filtered through and he therefore considered that a disease investigation staff in the provinces he had mentioned was highly necessary. Major Stirling pointed out that there was great scope for veterinary investigation in the Central Provinces, as in these Provinces they probably had almost every disease known to the veterinary profession. He further stated that, unless this Board recommended some annual grant of money to the Central Provinces, it was unlikely that an investigating veterinary officer would be appointed there for many years. Mr. Quirke said that they in the Punjab knew that disease was coming in from the North-West but they had no powers to take remedial measures. Dr. Hyder replied that all countries adopted control measures on their frontiers but that the first requirement was the ascertainment of facts. Mr. Davadhar supported Dr. Hyder in the resolution which he moved :—

"That the sum proposed be raised to one lakh of rupees for bringing effectively the North-West Frontier Province and Baluchistan into line with the rest of British India for the protection of the country".

Professor Aghurkar said that he could not understand why it was taken for granted that there were no veterinary officers in any of the provinces who could or were able to do the work of collecting informa-

tion. Further why could not veterinary graduates be deputed to do such work. The Board, in his opinion, should be satisfied that the work could not be done by the agencies which existed at present before recommending the creation of a new agency. The Professors of Pathology at veterinary colleges might, in his opinion, also be asked to take a hand in disease investigation. Mr. Taylor replied that Professors of Pathology were fully employed with work in the colleges and had no time to do field investigation—a statement to which Professor Agharkar demurred. In the latter's experience Professors of Colleges could and did do field investigations as well as their ordinary college duties. Mr. Taylor was in entire agreement with the difference which Colonel Olver had made between research officers and investigators. In his opinion investigators should have the highest possible qualifications which according to Mr. Hewlett ordinary veterinary graduates of Indian Colleges do not possess. They could not be considered on the same level of education as University graduates. Professor Agharkar replied that the only inference which could be drawn from this state of affairs was that the education given in veterinary colleges in India was highly defective. Mr. Collins pleaded for the inclusion of Indian States especially Hyderabad which was a constituent of the Council in any general co-ordinated scheme of veterinary investigation as the present one. The solution of the veterinary disease problems of Hyderabad was very important not only to Hyderabad but to the adjoining British territory. In so far as the State which he represented was concerned it was not so financially bankrupt as some of the British Provinces and would very likely be able to contribute something towards the scheme if it was included therein. He was therefore of opinion that the Council should help Hyderabad which was prepared to help itself. Colonel Olver in answering the various points raised in the discussion stated that it was unfortunate that the training at present given in the veterinary Colleges in India was not of a sufficiently high standard to fit the graduates from there for work of the nature proposed. He hoped that in course of time arrangements would be made for giving veterinary instruction of a higher standard at the Lahore Veterinary College. He did not think that the College staff could do investigation, they could only submit material for research. Veterinary Officers in the districts on the other hand had their hands fully tied with disease control work and had no time for investigation. He was quite agreeable to the inclusion of Hyderabad in the general scheme as well as to that of the North-West Frontier Province, but he did not think that the case for the inclusion of Baluchistan was very strong. The country was very sparsely populated and, in his opinion, they ought to wait till a reconstituted Sind would take charge of veterinary questions in Baluchistan. Dr. Agharkar was of opinion that if a questionnaire carefully designed were drawn up and distributed to district officers they would probably be able to collect all the information required. Mr. Saunders wanted Madras and Mr. Quirke the Punjab to be brought into the scheme. There was no reason in the former's opinion why if a province had done something on its own it should be denied what was being granted to provinces which had lagged behind. Mr. Quirke said that for lack of funds the services of the officer recently appointed in the Punjab could not be utilised to the full extent. Mr. Hewlett and Professor Ganguli thought that the staff should work under the Council but this was opposed by Colonel Olver, Mr. Milne and Mr. Kerr. In their opinion it was better to let the work be under the

Provincial Directors of Veterinary Services. When a staff centrally controlled was working in a province it was generally found that it was jealous of advice or direction from the local authorities. The Provincial Directors were better acquainted with local conditions and, if held responsible for the work, would have every incentive to see that their local staff gave the special staff every possible assistance. They therefore thought that collaboration between the central and the local authorities which was so desirable could be best achieved if the actual workers were under the control and direction of the latter which in turn kept touch with the central organisation. Mr. Hilson thought that the scheme was incomplete. In his opinion what was required to complete it was to obtain the concurrence of provinces and Indian States not included in the scheme to their supplying information to a central authority which should also be created. It was little use collecting information in certain places and leaving matters at that. Colonel Olver said that he quite realised that the scheme was incomplete and he also visualised the time when the creation of a central organisation would become imperative. This scheme was meant merely to start things. If it proved a success it could and would be developed. Mr. Carpenter said that Mr. Hilson's point was a very good one. He would also emphasize the desirability of a central co-ordinating head. He thought that the Council should at least have a scheme for a central office so that even if it was not sanctioned at once for lack of funds the Council would know the directions in which expenditure would have to be incurred in the future if the present scheme (Appendix XI) were sanctioned. The great thing, in his opinion, was co-ordination and there were not many difficulties in the matter of a central organisation. The obvious person, in his opinion, to be the head of any such organisation was the Director of Muktesar helped with a special *ad-hoc* staff. The Chairman in winding up the discussion said that he had been greatly impressed with what had fallen from Dr. Agharkar but as unfortunately seemed to be the case that the veterinary staff at present in India was neither adequate nor of a high enough quality there might be occasion in certain cases to depend upon Indians who had had their veterinary training abroad until at least such time as facilities to which Colonel Olver had referred for higher veterinary training were provided at the Lahore Veterinary College.

In the matter of control the Chairman considered that on the whole it would be better in this case to delegate control to Provincial agencies rather than keep it in the hands of the Council. He would, however, lay down no hard and fast rules but consider each case as it came along on its merits. He was attracted with the idea of a co-ordinated scheme as suggested by Messrs. Hilson and Carpenter, but he was afraid that if the Council waited till such a very comprehensive scheme was worked out and financed they might end in doing nothing. He was therefore in favour of the Board being satisfied with the degree of co-ordination and comprehensiveness achieved in Colonel Olver's scheme. (Appendix XII).

The Board then proceeded to vote on the several proposals made. The proposal finally accepted was to recommend for sanction Colonel Olver's co-ordinated scheme with the inclusion therein of Hyderabad, the North-West Frontier Province and Baluchistan, each unit costing about Rs. 10,000 per annum *minus* such sum as Hyderabad would be prepared to contribute towards the work within its own territory. It was reckoned that the total expenditure would be in

the neighbourhood of a lakh and ten thousand per annum minus the Hyderabad contribution (unspecified). The scheme would be for five years.

4. *Proposals for (a) investigations on virus diseases of plants, and (b) physiologic forms of wheat rust in Bombay (subject No. 11 of the agenda). (Appendix XIII).*—The Chairman announced that the Board announced that the Board would take the two schemes separately into consideration.

5. *Investigations on virus diseases of plants [subject 11 (a). (Appendix XIII)].*—After Mr. Main had explained the scheme Messrs. Burt and McRae spoke in support of it. Dr. McRae's previous comments on this scheme had already been circulated to the Board. Mr. Carpenter enquired whether it would not be advisable to make the scheme into an all-India one rather than localise it. Dr. McRae replied that very little was known about virus disease. Samples would have to be taken and they might just as well be the plants proposed in the present scheme. When so little was known on the subject it was better to begin in a small way; after all even if an all-India scheme was planned they would have to take examples and the ones proposed in the present scheme were, in his opinion, quite suitable. Dr. Keen agreeing with Dr. McRae said that in regard to virus diseases so little was known that it was as well to have a local investigation which might provide clues; thereafter it might be possible and desirable to work out a co-ordinated scheme for all-India. Dr. Keen further drew attention to the statement in the letter from the Director of Agriculture, Bombay, to the Government of Bombay, dated the 5th April 1930 in which mention was made of the co-operation of Dr. Uppal, Dr. Likhite and Mr. F. J. Dastur in the working of this scheme. These three scientists would not be working in the same laboratory but in places far apart. It would therefore not be team work of which he was all in favour but rather committee work which was not so desirable. Mr. Main explained that Dr. Keen had somewhat misunderstood the position which arose out of the fact that both the schemes, namely, the one on virus diseases and that on the physiologic forms of wheat rust were dealt with in one and the same letter. In actual fact the scheme of research on virus diseases would be under Dr. Uppal in collaboration with, as Mr. Burt added, Dr. Likhite of Baroda. Before putting the scheme to the vote the Chairman observed that one financial statement had been drawn up for both the schemes. It was therefore not possible to state what grant the Council would have to make if only the scheme on virus diseases was recommended by the Board and sanctioned by the Governing Body. He therefore suggested that the Board should approve the scheme and leave the question of the amount of money to be provided therefor to be worked out separately.

The Board agreed to the Chairman's suggestion and approved the scheme.

6. *Investigations on physiologic forms of wheat rust in Bombay [subject 11 (b). (Appendix XIII)].*—After Mr. Main had introduced the scheme the Board adjourned till 11 A.M. on the 15th.

M. S. A. HYDARI.

The 14th January 1931.

PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD OF
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH
HELD AT NEW DELHI ON THURSDAY, THE 15TH JANUARY
1921.

The following were present :—

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, *Chairman*.
2. Mr. B. C. BURT.
3. Mr. P. H. CARPENTER.
4. Mr. G. K. DEVADHAR.
5. Mr. R. S. FINLOW.
6. Dr. N. N. GANGULI.
7. Mr. K. HEWLETT.
8. Mr. G. R. HILSON.
9. Dr. L. K. HYDER.
10. Mr. NIZAMUDDIN HYDER.
11. Dr. B. A. KEEN.
12. Mr. P. J. KERR.
13. Mr. T. F. MAIN.
14. Mr. D. MILNE.
15. Colonel A. OLIVER.
16. Mr. F. J. PLYMLEN.
17. Mr. W. ROBERTSON-BROWN.
18. Mr. P. T. SAUNDERS.
19. Mr. R. L. SETHI.
20. Major R. F. STIRLING.
21. Mr. W. TAYLOR.

Mr. M. S. A. HYDARI, *Secretary*.

The following attended as visitors :—

1. Dr. S. P. AGHARKAR.
2. Mr. B. A. COLLINS.
3. Dr. W. MORAE.
4. Dr. K. C. MEHTA.
5. Mr. F. J. WARTH.

2. The meeting lasted from 11 A.M. till 4.45 P.M. with an interval for lunch from 1.40 to 3 P.M.

3. *Proposals for investigations on the physiologic forms of wheat rust in Bombay (subject 11 (b) of the agenda). (Appendix XIII).—* Dr. Mehta spoke in explanation of his note (Appendix XIII) on the Bombay scheme which had been circulated to the Board. He considered

that there would be a definite advantage if this scheme were postponed till he could put before the Council the results of his investigations which he hoped would be completed by 1932. What he was after in his scheme was to breed rust resisting varieties for the hills. If this could be done the advance of the rust into the plains would be stopped to a great extent. He therefore felt that consideration of the Bombay scheme (Appendix XIII) should be postponed for the time being and that later when the results from his own investigations were available a co-ordinated scheme should be drawn up with the help of Mycologists in India for an attack on the problems which would then remain to be solved. Dr. Mehta informed Professor Ganguli that his first report would be submitted in March 1931 but that would only be a progress report containing no conclusions. Dr. Mehta said that the problem appeared to him to be as follows. Supposing Dr. Mehta found that the rust only came through the hills the thing became simple. There was no necessity then for breeding rust resisting varieties in the plains. If, however, it was found that forms of rust did exist in the plains then infection was not eliminated but only reduced by the growing of rust resisting varieties in the hills. In the latter contingency it would mean that instead of tackling the problem of rust in the plains now along side with Dr. Mehta's investigation into rust in the hills they would have to start two or three years later; he was not in favour of this loss of time. Mr. Burt said that he was in favour of waiting till the Council had before it Dr. Mehta's preliminary results. The big wheat growing area was concentrated in the North where the solid weight of wheat cultivation lay. Before therefore subsidiary investigations like the one proposed by Bombay (Appendix XIII) were supported he should like to see the preliminary results and then have the matter discussed in the summer session of the Advisory Board in 1932. If Dr. Mehta was right that the rust came solely from the hills then the problem was simplified; if he was not correct then a much bigger organisation than had hitherto been contemplated would have to be evolved to tackle the problem on an all-India basis. He was therefore in favour of passing no opinion on the Bombay scheme (Appendix XIII) till the summer meeting of the Advisory Board in 1932. In reply to Mr. Hilson who enquired whether the wheat plant was the only one which passed on rust to the plains Dr. Mehta replied that the chances were remote that plants other than wheat would transmit the kind of rust which affected wheat in the plains. The rusts of wheat and those found on grasses were totally different. Answering Dr. McRae, Dr. Mehta said that he was convinced that there was no rust which lived through the summer in the plains. The high temperature killed it. Mr. Carpenter was in favour of Mr. Burt's proposal to postpone consideration of the Bombay scheme. Dr. Agharkar in supporting the Bombay scheme said that rust appeared in the Deccan at the same time as in Northern India. If therefore it came from the hills how was it that it did not appear later in the Deccan than in Northern India. He thought it might be possible therefore that there were other sources of infection and he was in favour of allowing Bombay to carry on the investigation at the modest financial cost proposed. In reply to Dr. Hyder Mr. Main informed him that the altitude of Poona was about 2,000 feet above sea level, the maximum temperature being about 105° in the hot weather and in the seventies in the cold weather, while the minimum was about the freezing point. The maximum height

of the Western Ghats was 4,500 to 5,000 feet. Dr. Mehta also in reply to Dr. Hyder said that the limit of cultivation in the Himalayas went up to about 9,000 feet. In the Kumaon hills, no rust survived below 4,000 feet. Mr. Plymen referring to Dr. Agharkar's point as to the simultaneous appearance of rust in Northern India and Deccan said that there was no question of a race from north to south. The rust was probably there already. It was the climatic conditions which brought it out. He agreed that a comprehensive scheme should be drawn up with the help of Mycologists in India including Dr. Mehta and that the Punjab and the United Provinces which were the largest wheat growing areas in India should be brought into the scheme. Mr. Milne agreeing with Mr. Plymen said that he noticed that the intensity of the rust did not seem to decrease with the distance from the hills and he thought that there might just be a possibility that rust survived in the plains from year to year. He therefore suggested that a committee should be appointed which would formulate a co-ordinated programme of research. Mr. Main pointed out that there was no reference to physiological forms in the Wheat Rust Scheme drawn up by Dr. Mehta a year ago and sanctioned by the Imperial Council of Agricultural Research. He pointed out that the Bombay Scheme was before the Council before Dr. Mehta turned his attention to the physiological forms of rust, and he thought that the argument that the scheme should be postponed, pending the discovery of the origin of rust, was not convincing, especially as all the mycologists, except Dr. Mehta, including Dr. Macfadyen, Dr. Uppal and Mr. Dasgupta were in favour of proceeding with the scheme. Mr. Devadhar was in favour of approving the Bombay scheme.

The Board was of opinion that the Bombay scheme should lie over for the present and that in the meantime a reference should be made to a committee of Mycologists, including Dr. Mehta, to work out a co-ordinated scheme of rust research; no definite time was fixed for the committee, whose personnel it was left for the Chairman to fix, to submit its report.

4. *Application from Dr. S. S. Bhatnagar for a grant of Rs. 3,000 a year, for two years, for research on the effect of different ions on plant growth (subject No. 12 of the agenda). (Appendix XIV).*—Mr. Milne introduced the proposal which both Mr. Burt and Dr. Keen supported. The latter said that the research proposed by Dr. Bhatnagar was not only a piece of fundamental research work but would have a practical bearing. At the present time, for example, certain manufacturers of manures added substances such as those mentioned by Professor Bhatnagar in his letter which they claimed added to the effectiveness of such manures. The latter, of course, they sold at a higher price. It was not possible for Agricultural Departments to advise on what might be called "doctored" manures without the information which work like that proposed by Dr. Bhatnagar would give. He therefore heartily supported the scheme and would draw Professor Bhatnagar's attention to the work of Dr. Voelcker at Woburn which had been financed out of the Hill bequest. Dr. Voelcker's work was highly suggestive and might be of assistance to Dr. Bhatnagar in his investigations. The Board agreed to recommend the scheme for sanction.

5. *Application from Dr. S. S. Bhatnagar for a grant of Rs. 4,150 a year, for two years, for investigations on the relation between the physico chemical properties and fertility of soils (subject No. 13 of the*

agenda). (Appendix XV).—Mr. Milne introduced this scheme. Dr. Keen said that he was not as enthusiastic about this scheme as he was for the previous one. In this connection he drew attention to paragraph 2 of Professor Bhatnagar's letter (Appendix XV) which ran as follows :—

"The whole province will be divided into a number of climatic zones and representative soil samples will be taken from each area. The fertility value will be ascribed to each sample from a knowledge of the cropping history, ascertained from the actual farmers and other men on the spot and the Agricultural Department".

He said that no definite value of the fertility of a soil could be given and that therefore there could be no effective correlation between exact data obtained by the laboratory tests and vague statements about good, moderate or indifferent fertility. This, in his opinion, was the weak point of the scheme. It really brought out the disadvantage from which the scientist suffered when he came down to tackle the problems of practical agriculture. Mr. Milne said that they of the Punjab Provincial Research Committee had realised what Dr. Keen had pointed out but they had felt that in view of the definite data regarding crop cutting experiments, etc., available in the Punjab Government Farms useful results might be obtained by having a try especially as the cost of the scheme was very modest. Mr. Burt explained that he had since had a conversation with Dr. Bhatnagar who had informed him that he proposed in the first place to begin on the soils from Kalabagh near the Khewra Salt Range some of which are barren probably due to the presence of sulphides. As regards the more general problem, Dr. Bhatnagar considered that he could get the necessary fertility records from Government Experimental Farms and from a few private land-holders who had the records of yields in different fields for a series of years. Mr. Burt thought that in any case the first problem which Professor Bhatnagar proposed to tackle was definite enough. Dr. Keen agreed that this had provided a clear issue and he was therefore prepared to support the scheme, all the more so if he would be allowed to assist Dr. Bhatnagar in the course of his research. Mr. Milne said that any assistance which Dr. Keen could give would be heartily welcomed not only by himself but by the Punjab Research Committee.

Finally the Board agreed to recommend the scheme for sanction on the understanding that the problem of barrenness in Punjab soils from causes other than alkali would form the first part of Dr. Bhatnagar's investigation.

6. *Scheme for the appointment of a Physical Assistant on the staff of the Agricultural Chemist, Bengal, (subject No. 14 of the agenda). (Appendix XVI).*—Mr. Finlow introduced the scheme. Mr. Burt said that unless the Agricultural Chemist, Bengal, got an Assistant he could not collaborate with the Dacca University in the soil work for which the Council had recently given a grant; but for the absence of Mr. Finlow on leave the present proposal would have been made to the Council along with the Dacca scheme and as a part of it. Professor Ganguli also spoke in support.

The Board agreed to recommend the grant for sanction.

7. *Application for a grant for experiments on manuring and marketing new types of barley (subject No. 15 of the agenda). (Appendix XVII).*—Mr. Sekhi introduced the scheme. Mr. Burt said that it was

very satisfactory to note that through the agency of the Indian Trade Commissioner arrangements had now been made whereby at the request of the Council the Institute of Brewing would carry out detailed examination of barleys including actual malting tests at the moderate cost of from 2 to 4 guineas per sample. Mr. Milne recalled that a few years ago a firm of barley exporters had found that while certain cargoes of barley which they exported to England from the Punjab were quite good, other cargoes did not germinate evenly on the malting floor. He had found that barleys from different localities germinated after different periods in germination pens and he advised firms to see that consignments from Karachi consisted of barleys from the same locality. He thought that this was a matter which should be further investigated. In any case he would like the Punjab to be included in this investigation. Mr. Burt said that there would be no difficulty in the Punjab participating, if Mr. Milne would put up a suitable scheme it could be considered at the next meeting of the Board.

The Board agreed to recommend the scheme for sanction.

8. (a) *Establishment of Nutrition research sections in major provinces to work in collaboration with the proposed Nutrition Institute at Dehra Dun.* (b) *Appointment of a Physiological Chemist to study Animal Nutrition problems of Dacca, (subject No. 16 of the agenda).* (Appendix XVIII) —Colonel Oliver in introducing the scheme remarked that he would like the Bengal scheme to be considered as forming part of the co-ordinated scheme which he had prepared for the Board's consideration. Mr. Warth said that there was no question either for the need or for the value of this work but he was doubtful whether they would get suitable men to do it all at once. Mr. Finlow said that the Bengal scheme (Appendix XVIII) was a logical outcome of the work done in Bengal on cattle for the last 15 years. The cattle in North East India were the worst in India but it was of little use improving the quality of the cattle unless there was food for them. He gave the assurance that any work which would be carried on at Dacca would be in collaboration with Mr. Warth and that they would welcome any suggestions which Colonel Oliver would make. Dr. Agharkar thought that the Council should wait and see the results of the Central Institute at Dehra Dun proposals in regard to which had been discussed by the Board the other day. The argument had been advanced that at the Central Research Institute at Dehra Dun they would be able to test all kinds of fodder. In the circumstances he was for cutting off these provincial offshoots. Mr. Wilson said that the Council was dealing with sugarcane, rice and animal diseases as all-India problems. He wondered whether the Council should not take stock of its position and as its means were limited draw up a list of schemes in the order of urgency instead of considering schemes as they came up. If such a list were drawn up he would put the present scheme as being among the first. Professor Ganeruli recommended that each province should draw up a scheme and collect all the information on fodders available. Thereafter the Animal Husbandry Expert to the Council should put up a combined scheme for the consideration of the Board. Colonel Oliver answering Professor Agharkar said that the Central Institute of animal Nutrition at Dehra Dun would certainly test all kinds of fodder but that it could not obviously carry out field experiments in the provinces. He agreed that one of the difficulties would be to get suitable workers, but he hoped that when the Central Institute of

Animal Nutrition was started it would train and lend workers for provincial investigations. As he anticipated some delay in the foundation of such a Central Institute he thought that they should make a start with such schemes as the one submitted by Bengal. Professor Agharkar enquired whether Professors of Animal Physiology in Veterinary Colleges could not be pressed into service for this work. He objected to educational institutions in India being set aside when there was a question of research. Colonel Olver entirely agreed with Professor Agharkar that this should not be so; unfortunately Veterinary Colleges in India had generally no farms and therefore it would be difficult for the college staff in some places to take a hand in this work. On the other hand, the veterinary college at Patna had a farm and there he thought that animal nutrition work should be carried out at this farm with the necessary accommodation and facilities and that the assistance of the college staff should be invoked, this was, however, a matter which it was for the provinces to suggest. Mr. Milson also answering Professor Agharkar said that it was not only necessary to determine the feeding value of different fodders but also the reactions of the different breeds to different fodders in the different conditions in which they existed. Investigations in the provinces were therefore absolutely necessary.

The Chairman said that he would put the two schemes, namely, the Bengal scheme as well as Colonel Olver's general scheme to the vote separately, otherwise if only the general scheme was recommended by the Advisory Board but rejected by the Governing Body it might happen that the Bengal scheme which was a distinct one might be rejected *ipso facto*.

The Board agreed to recommend the Bengal scheme as well as the general scheme.

9. *Application from Dr. H. C. Chaudhuri for a grant of Rs. 12,600 spread over three years for investigation of the "wither tip" of citrus trees (subject No. 17 of the agenda). (Appendix XIX).*—Mr. Milne introduced the scheme which after Mr. Robertson-Brown and Mr. Carpenter, the latter saying that Assam was particularly interested in this investigation, had spoken in support the Board agreed to recommend for sanction.

10. *Proposals for the establishment of a research station at Shillong for the development of Bee-keeping in India (subject No. 18 of the agenda). (Appendix XX).*—Dr. Keen in introducing the scheme said that if it was desired to develop bee-keeping in India the way suggested in the scheme of the Imperial Entomologist was the way to do it, but Dr. Keen had no knowledge of the demand in the country and he thought that the Board should be guided in this matter by the views of representatives of the provinces. He also thought that it would be very difficult to get the right type of man to take charge of this scheme. Dr. Hyder supported the scheme on the ground that it might lead, if successful, to the establishment of a cottage industry in India. The Royal Commission on Agriculture had stressed the importance of the development of cottage industries in India. Professor Agharkar said that he was diffident about the scheme as outlined. He saw that Rs. 20,000 per annum had been provided on account of the cost of the officer, and Rs. 10,000 for other items of expenditure and he considered the total cost excessive. He was also not in favour of appointing the expert from abroad who would go away after three years with all the accumulated

knowledge gathered by him which would be lost to India. If there was scope for the development of bee-keeping in India he thought a better course would be to send a promising student abroad with a scholarship who on his return could tackle with the subject. Mr. Plymen said that bee-keeping was not a matter of general importance in India and he was therefore not particularly keen on this scheme. He thought that the problem of bee-breeding should be one of the problems which should be referred for investigation to Universities with the help of a small grant. Mr. Collins said that he thought the scheme was too expensive. The bee-industry in India was not likely to become a cottage industry in the plains owing to climatic conditions. Flowers grew in India all the year round and there was therefore no incentive such as they had in colder climates for bees in India to store their honey except in very limited areas. If, however, it was desired to investigate the question he would suggest either, as Dr. Agharkar had proposed, to send a student from India with a scholarship abroad or, as Mr. Plymen had recommended to add it to the list of problems which would be referred to Universities for a grant. Mr. Burt said that the economic problem should be kept separate from the technical. He did not think that on present information there was sufficient justification for the view advanced by Mr. Collins that India was not a suitable place for bee-keeping. It might be that if the right type of bee was obtained a cottage industry might be established. The question which they had to decide was whether bee-keeping was worth while. If the answer was in the affirmative then he would support the adoption of Dr. Agharkar's proposal to send a student abroad with a scholarship for training instead of importing an expert from abroad. Mr. Carpenter in opposing the whole scheme said that its annual cost was Rs. 30,000. The Board had been informed that for this amount three Animal Nutrition Sections could be run in the provinces. There was no question as to the relative importance of the two. This was only an example. In his opinion there were many much more important problems both in agriculture and animal husbandry than bee-keeping to which the Council could profitably devote its funds.

The Board did not recommend the scheme for sanction.

11. (a) *Revised scheme of research in fruit-growing in Madras. (Appendix XXI).* (b) *Scheme from Assam for investigating the possibilities of fruit culture in Assam (Appendix XXII) (subject No. 20 of the agenda).*—There was a general feeling in the Board that there was need for fruit research both in the provinces and at a central station. As it happened the only provinces which had submitted schemes of fruit research were Madras and Assam. (Appendices XXI and XXII). The Board was of opinion that instead of considering individual isolated schemes it would be better if a committee were to go into the whole question of fruit research in India and submit proposals for work. At the same time it was felt that such a proceeding would not be quite fair to Madras which when it had come to the Board with a scheme for fruit research at its last meeting in June 1930 had been asked to revise it in certain respects and in the hope also that in the interval other provinces concerned would submit fruit schemes so that the problem could be discussed as a whole. No other province, except Assam, (Appendix XXII) had done so and it was rather hard that Madras which had revised its scheme (Appendix XXI) should have to wait a further period for its consideration.

On the other hand the Board felt strongly that the problem should be tackled as a whole and with the consent of Mr. Hilson, the Madras representative, agreed that a fruit committee should be constituted which would meet about three months hence to sift schemes of fruit research and to make proposals; that this committee should examine the Madras scheme first and that the scheme, if approved, by the committee with or without amendment, should be submitted direct to the Governing Body without its being brought before the Advisory Board as would be done in the case of other schemes. The period of three months was given to enable provinces to come forward with such proposals for fruit research as they thought necessary.

The Board also agreed with Mr. Plymen that full advantage should be taken of such assistance in the examination of schemes as the Imperial Bureau of Fruit Production at East Malling could render. Though such a proceeding was somewhat unusual it would probably be advisable in view of the fact that very little scientific work on fruit had of recent years been done in India, to utilise the store of information available at the Bureau.

12. *Application for a grant for experimental work on the cold storage of mangoes and for experimental shipments of mangoes to Europe (subject No. 19 of the agenda).*—The Bombay Government had requested that consideration of this scheme be postponed for the present. This was agreed to.

13. *Application from Mr. A. H. Slater, Mission Poultry Farm, Etah, for a grant for 5 years for breeding experiments in connection with the improvement of goats (subject No. 21 of the agenda). (Appendix XXIII).*—Colonel Olver speaking in support of the scheme said that the local Government should pay the capital expenditure thereon. Mr. Collins said that the Council should assist the scheme. In Hyderabad they were going to do the same thing as was proposed in the present scheme without asking the Council to contribute and he agreed with Colonel Olver that the local Government should be asked to bear the capital expenditure on this scheme. He also noticed that income had not been allowed for in the form of receipts. In reply to Mr. Devadhar Col. Olver stated that the scheme for the improvement of the breed of goats was meant as a measure of research and not as a business and for that reason it was not contemplated to produce bigger number of animals of this type for which the establishment of Co-operative Societies and the encouragement of Co-operative Societies among the villagers would be one of the ways. Dr. Agharkar asked whether the research would be towards the improvement of goat milk or goat meat. Mr. Sethi informed him that the research would be for the improvement of milk. Dr. Hyder supported the scheme and bore testimony to the good work already done by Dr. Slater in spreading improved strains of poultry in the tract round about his mission. Mr. Burt said that the Jamnapari breed of goats was so good that some years ago the Dutch found it worth while to import considerable numbers into Java. If this breed was saved from extinction and at the same time kept up to standard it would help the Jamnapari tract in the United Provinces which was the most famine stricken part of that province. When asked by the Chairman whether he could suggest a compromise in regard to the share of the Local Government in the cost of

the scheme Mr. Burt proposed that the local Government be asked to pay Rs. 8,000 out of the total capital expenditure of Rs. 15,000.

The Board agreed to recommend the scheme subject to the local Government finding Rs. 8,000 out of the total non-recurring expenditure of Rs. 15,000, the Council bearing the whole of the recurring expenditure.

M. S. A. HYDARI.

The 15th January 1931.

PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD
OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH
HELD AT NEW DELHI ON FRIDAY, THE 16TH JANUARY
1931.

The following were present :—

1. Diwan Bahadur Sir T. VLAYARAGHACHARYA, *Chairman*.
2. Major F. H. BUDEN.
3. Mr. P. C. BURT.
4. Mr. P. H. CARPENTER.
5. Mr. G. K. DEVAPPA.
6. Mr. R. S. FINLOW.
7. Dr. N. N. GANGULI.
8. Mr. K. HEWLETT.
9. Mr. G. R. HESON.
10. Dr. L. K. HYDER.
11. Mr. NIZAMUDDIN HYDER.
12. Dr. B. A. KEEN.
13. Mr. T. F. MAIN.
14. Mr. D. MILNE.
15. Colonel A. OLVER.
16. Mr. F. J. PLYM-FY.
17. Mr. W. ROBERTSON-BROWN.
18. Mr. P. T. SAUNDERS.
19. Mr. R. L. SETHI.
20. Mr. W. TAYLOR.

Mr. M. S. A. HYDER, *Secretary*.

The following attended as visitors :—

1. Dr. S. P. AGHARKAR.
2. Mr. W. T. ALDOUS.
3. Mr. B. A. COLLINS.
4. Dr. W. McRAE.

2 The meeting lasted from 11 A.M. till 5-20 P.M. with an interval for lunch from 1-10 P.M. to 3 P.M.

3. *Production of agricultural cinema films.* (Subject No 22 of the agenda) (Appendix XXIV).—In introducing the subject Mr. Burt said that he had reckoned roughly that the total cost on account of the pay and travelling allowance of two men in India for six months *plus* the cost of pay for one man who will be deputed to England for 12 months would be at least Rs. 12,000. The question which was for the consideration of the Board was as to what would be the duties of this man and his assistant when the former returned from abroad ; and also whether they should

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be under the Council and who would be responsible for their pay. The film officer would have to acquire a thorough knowledge of the production of educational films. The Chairman announced that while in England the Empire Marketing Board had informed him that the Board would pay the cost of passage to England and back *plus* all the incidental expenses of training in England provided the Council bore the charges for the pay of the man deputed. Major Budden said that the Railway Board had had now over three years' experience of film production and he had found it to be a highly technical matter. He did not think that the proposal to lend an officer to provinces would work satisfactorily, as an officer by himself could do little. He must have skilled staff working with him and a place where he could try out and edit his films and it would be advisable to attach him to some existing bureau. If he were attached to the Central Publicity Bureau of the Indian Railways he would be able to make use of their apparatus and existing organisation and would also have the advice and help of the Railway Cinema Expert. As the Railways were greatly interested in the development of agriculture in India they were naturally keen on exploring every possible avenue of co-operation of which the present proposal was one. He also thought that it would be difficult to find a man in India to take up the post on less than Rs. 500 a month. It should be remembered that the man selected should, apart from any training which he might have had or might acquire with the assistance of the Council, have a share for film production work. The selection of a suitable man would therefore be a matter of some difficulty and he would therefore recommend the appointment of two men on probation of whom the better one would be selected after six months. Mr. Milne said that they in the Punjab wanted highly technical advice from a specialist who would help in drawing out sceneries and edit their films. He acknowledged the assistance which the Railway Board had already given them in the matter of films and advised that the Research Council should collaborate with the Railway Board. Mr. Plymou also supported Major Budden's idea of the Council collaborating with the Railway Board in this matter and of utilising the facilities offered. In answer to the Chairman Major Budden informed him that the total expenditure on the production of films by the Central Publicity Bureau was last year about Rs. 1,75,000. Mr. Collins said that in Hyderabad also they were interested in the production of agricultural cinema films and he had a film on sugarcane under consideration. They did not make their own films but a local company had agreed to do it at the rate of Re. 1 per foot and for duplicates at Re. -1/- per foot. He would like to know whether these rates were reasonable. He also wondered whether the provision of only one man by the Council would really do much good. There would be seasons in the year like the sowing season and harvest time when all provinces would be wanting the Council's film expert. That was a difficulty. Mr. Finlow was for joining in with the Railway Board in this matter. He said that he had found the films made by them for his Department very good. Mr. Milne answering Mr. Collins's difficulty said that it would probably be necessary for a province to have its own cameraman who could take photos at the proper time on the spot, the Expert from the Council helping with the scenario. Major Budden said that he thought that provinces would probably find it too expensive each to have a cameraman of the necessary qualifications for taking films and a possible solution would be to have one or two good cameramen under the Council who could be loaned out to provinces. The work of a cameraman was also highly technical now a-days if good films

were to be produced. The Chairman said that while in England he had had discussions on this subject and he felt doubtful whether it would be possible to train a man in a short period of time, also the position was changing owing to the advent of the talkies. They were in a transitional period and as expenditure on any cinema scheme of the Council would run to far more than a few thousands per annum he thought that it would be advisable to wait. Mr. Devadhar said that while he appreciated the fact that silent films were giving place to talkies he thought that the former could still in India at least play a very useful role as means of instruction. He therefore recommended that a small committee should be formed to collect necessary data and that the matter should not be shelved till some other time. Mr. Main was in favour of Major Budden's proposal and he said that they in Bombay had felt the need for bringing artistry and technique to bear on their agricultural propaganda films. Mr. Wilson said that he was doubtful about the usefulness of cinema for agricultural propaganda. He understood that Java's experience in this respect had not been satisfactory. Film exhibitions were undoubtedly very attractive but their utilitarian value was small. The practice they had adopted in Java was to have a short length of film and use it in place of a lantern slide in the course of instruction. He proposed to try this method in Madras. Short length films were preferable to glass slides as they could be rolled up and took up little space. Dr. Agharkar was not quite convinced about the utilitarian value of film exhibitions. He was doubtful if they brought conviction; that was not surprising as operations covering months were compressed over a short period of time. An unsophisticated villager considered this somewhat unreal. He thought that the Council would be well advised not to embark on such schemes of dubious utility. Mr. Plymen disagreeing said that before a person could be convinced he had to be interested. His idea was not that a film should be left to tell its own story but that when showing the film there should be an agricultural instructor who would give a running lecture as the scenes were projected on the screen. He would thus transform the silent film into a talkie. Major Budden answering some of the points raised in the discussion said that he would not advise engaging a man permanently but on contract. This was the usual commercial practice and was what they were doing in the Central Publicity Bureau. If a film officer could produce six good films per year not exceeding two reels each, he would be doing very good work and this would be as much as the Council would have reason to expect. In regard to the difficulty about one man not being enough to go round all the provinces he thought that some arrangement could be arrived at between his Department and the Council whereby one of his men would be lent to the Council at the busy agricultural season, the Council at the slack times lending its man in return. The railway rate for producing films was Re. 0.8-0 per foot if the buyer bought two films and annas six a foot for duplicate copies. He thought that a local company with low supervision charges should be able to produce straight forward films at Re. 1 per foot as quoted by Mr. Collins but the actual cost of duplicates could not be less than annas four a foot excluding any share of overhead expenses. The average instructional film was of two reels or upto 2,000 feet but they varied from 500 ft. to 4,000 ft. At this stage the Chairman put Mr. Devadhar's resolution which had been tabled previously and seconded by Dr. Hyder to the Board which adopted it. It ran as follows :--

"Considering the great importance and practical utility of cinema films on agricultural and allied subjects as the most effective

means of popular adult education and the general interest in carrying out into effect the most useful and valuable results of the work of research conducted by various workers in the domain of useful agricultural (and veterinary) or livestock improvement and advancement, this Board is of opinion that no time should be lost in getting films manufactured; and for that purpose a sub-committee composed of the representatives of provinces where such attempts have already been made be appointed to make definite proposals to this Council both as regards the subjects to be selected and the best agencies to whom the work be entrusted under the supervision of that sub-committee and the Central Publicity Bureau of the Railway Board; and that a sum not exceeding Rs. 25,000 be provided for the production of four or five films of more than 3,000 to 4,000 feet at rates not exceeding those stipulated or worked by the Central Publicity Bureau."

4. *Testing of Indian agricultural products in England (subject No. 23 of the agenda) (Appendix XXV).*—Noted.

5. *Application from the Government of Madras for a grant for research work on potatoes (subject No. 21 of the agenda) (Appendix XXVI).*—Mr. Wilson introduced the scheme which Mr. Burt supported subject to the provision of Rs. 8,000 for quarters being borne by the Provincial Government. He said that the potato crop was of great and growing importance. The import of European varieties for sowing was chiefly useful in hill tracts as the selection and breeding of potatoes for cultivation in the plains in India presented distinct problems. He was of opinion that just as in the case of sugarcane cultivation the cultivation of potatoes would not progress in India till the breeding and testing of types suitable for Indian conditions was taken up here. All the Directors of Agriculture present supported the scheme with a proviso that the expenditure of Rs. 8,000 for quarters should be met by the local Government. The Chairman suggested that it would be as well to pass the scheme with the above proviso rather than to refer it back to the local Government for an expression of their views in regard to the latter's share of the cost; for if it was approved by the Governing Body the local Government could be approached with a definite proposal that the Council would be willing to finance the scheme (Appendix XXVI) if the local Government on their part bore their reasonable share.

The Board agreed to recommend the scheme subject to the rider suggested by the Chairman.

6. *Participation of India in the International Dairy Congress, Copenhagen, 1931. (Subject No. 25 of the agenda) (Appendix XXVII).*—Colonel Oliver introduced the subject. Mr. Hewlett suggested that one at least of the members of the proposed delegation should be a veterinary officer. He suggested Mr. Kerr's name in the first place and if two veterinary officers were sent he would add Mr. Taylor's also. Mr. Finlow suggested Mr. Gossip. The Chairman said that these suggestions would be considered when the proposal was made to the Governing Body in regard to the composition of the delegation. He thought that probably one delegate would be sent from India. Mr. Devadhar said that in that case he would like this delegate to look to the co-operative dairy activities in Denmark.

The Board recommended that India should participate in the International Dairy Congress, Copenhagen, 1931.

7. Representation from Kirloskar Bros., in regard to the rates of railway freight charged on agricultural implements. (Subject No 26 of the agenda) (Appendix XXVIII).—After Mr. Burt had introduced the subject, Major Budden, the railway representative on the Board, said that he would refer members to his note (Appendix XXVIII) on Messrs. Kirloskar Brothers' representation which had been circulated to the Board. Dr. Hyder said that the present was a time of very acute distress for the agriculturist in India. It was no answer to the cry of the agriculturist to say, as the Railway Board usually said when freights were in question, that the rates were reasonable. In this connection he referred to paragraph 4 of Major Budden's note in which it was stated that Messrs. Kirloskar Brothers' had made no attempt to show that the railway charge for agricultural implements was not reasonable. Dr. Hyder held no brief for this company or for any other and he wanted it to be clearly understood that his remarks were not due to the present representation from Messrs. Kirloskar Brothers, but were actuated by the needs of the situation. The freights on wheat for example were considered "reasonable" before the pressure of public opinion had recently forced the railway authorities to reduce the freight on wheat from Lyallpur to Karachi. The rates would now be held up as reasonable just as the old rates had been! He therefore pleaded for an impartial examination of the position in so far as agricultural products and implements were concerned. He would probably be told that if any representation on railway rates had to be made, it should be made to the Railway Rates Advisory Committee. But he would submit that the Committee as constituted was hardly such as to inspire confidence among the public concerned. They did not want to be told that according to such and such a rule or such and such a principle the rates could not be altered. What they wanted was that the question of the rates should be examined from the point of view of the man who had occasion to send goods by rail and who could reconcile his needs with the duty of the railway administration to run the railways on commercial lines. If the railways helped the agriculturist in the matter of rates, he would in the long run bring more business to them. He therefore recommended that the question of freights affecting agricultural products and implements should be referred to a small committee composed of representatives of the Railway Board and others. Mr. Devadhar and Professor Ganguli supported Dr. Hyder's resolution, the latter inviting a reference to paragraph 316 of the Report of the Royal Commission on Agriculture. Mr. Hilson, speaking in support of Dr. Hyder's resolution, gave an instance of how rates might be reduced to the mutual benefit both of the railways and of the agriculturist. He said that he was importing a large number of Safary ploughs into Madras. The freight on these came to about Rs. 1 per plough. If the freight could be reduced by half, he would be able to sell many more ploughs; in this way railway traffic would be increased and the agriculturist also benefited. Mr. Collins also supported Dr. Hyder's resolution. Major Budden in reply assured the Board that railways did realise that they depended upon the prosperity of the Indian agriculturist for their own prosperity; but it should be borne in mind that railways were not philanthropists. Figures such as those given by Mr. Hilson were very helpful to railway administrations which were always willing to examine a position *de novo* and which had nothing to hide. Speaking therefore purely in his personal capacity and not as a representative of the Railway Board he thought that a committee such as that suggested by Dr. Hyder might perhaps do some good and help to

clear up some misunderstandings ; its labours would probably have to be somewhat prolonged as rates were a very intricate question. It should be remembered that railways have to earn enough to pay interest on the capital borrowed and in addition pay a contribution to General Revenues equivalent to another 1 per cent. This necessitated last year borrowing over two crores of rupees from the Reserve Fund and possibly considerably more would be needed this year. If rates were reduced for one class and there was no increase in traffic to make up for reduced earnings then other classes would have to pay more. The Chairman then put Dr. Hyder's resolution to the vote. It ran as follows :—

" That the Advisory Board of the Imperial Council of Agricultural Research recommends to the Railway Board that a committee composed of representatives of the Railway Board and others be appointed to examine the question of railway freight rates on agricultural products and implements."

The Board passed this resolution.

8. Assistance to be given by the Indian Railway Central Publicity Bureau to promoting agricultural and veterinary development. (Subject No. 27 of the agenda) (Appendix XXIX).—Major Budden introducing the subject said that he would like the views of members of the Advisory Board on the memorandum which he had submitted on the subject and which had been circulated to the Board. Mr. Burt said that by far the greatest help which railways could give to the agriculturist in India was to reduce the freight on agricultural produce. This point had already been dealt with in the resolution passed on subject No. 26 of the agenda ; but he would like to emphasise that Indian agriculture was passing through a very critical time and as a country which had a large export trade in agricultural produce, it was important that at a time when there was over production in the world the agriculturist in India should be assisted as much as possible in the matter of freight to maintain the position of his produce in the markets of the world. Mr. Plymen, as well as the other members of the Advisory Board, said that this question of freights was really the most important direction in which the railways could assist the agriculturist.

Opinion in the Board was divided in regard to the utility of provincial demonstration trains. Though their use had been discontinued in the Punjab and Bengal this year, that was not due to their being considered of little value, but because of financial stringency. Opinion was, however, definitely against the feasibility of running an all-India demonstration train owing to difficulties in regard to language and also because of the difference in varieties of crops grown. Major Budden informed the Board that he had prepared a pamphlet on demonstration trains which would be circulated to all members of the Board. Finally it was agreed to hold over the question of the utility of demonstration trains for consideration at the next meeting of the Advisory Board, so that in the interval members might have the opportunity of reading Major Budden's pamphlet as well as of considering the question further.

Opinion was in favour of the railways encouraging visits of cultivators to model farms, agricultural shows and exhibitions by means of concession tickets. The members of the Board were also in favour of the Directors of Agriculture being members of Provincial Railway Advisory Committees,

which at present had no representative of the Agricultural Department on them. The following suggestions also found favour with the Board :—

- (1) Allowing cows and buffaloes to be transported back from towns to the country at cheap rates when no longer in milk. This would avoid the present slaughter of good milking animals after their period of lactation.
- (2) The establishment of agricultural stalls at railway stations.
- (3) The exhibition and sale of agricultural implements approved by the provincial Department of Agriculture at railway stations.
- (4) Provision of improved types of cattle wagons for the transport of cattle. The railway representative, Major Budden, said that there were already special types of ventilated wagons on the railways, but the co-operation of cattle-owners was also necessary. As the amount charged was often for the whole wagon, there was a tendency on the part of cattle consignors to overcrowd the wagon.
- (5) Pictures on agricultural subjects in railway carriages. The railway representative said that they had tried having pictures and advertisements in third class compartments, but they found that these were generally torn up.

In the result the Board took note of Major Budden's suggestions and passed on to the consideration of the next item of the agenda.

9. *Dry-farming research scheme for the Bombay Deccan.* (Subject No 24 of the agenda) (Appendix XXX).—Mr. Main introducing the subject said that India's greatest agricultural problem was the rainfall; just about one-third of the total area of the Bombay Presidency was very liable to famine. That showed how important the problem of crop growth in areas of scanty rainfall which had been fully stated in the scheme (Appendix XXX) circulated to the Board was to the Bombay Presidency. There were three phenomena of special significance associated with the rainfall in the famine zone, (1) the small total which was round about 20 inches, dropping to 14 inches in some years, (2) the remarkable compression of three-fifths, or 12 inches, of this rainfall within a period of about 10 days, and (3) the huge run-off which amounted to about 50 per cent of the heavy rain. Hence this scheme might well be given the subtitle of "the better utilization of the rainfall". The reason for the necessity for sub-centres to a main central scheme lay in the fact that this species of research was closely wrapped up with factors of environment such as humidity, wind, moisture, sunshine, etc., which differed from tract to tract. He had no objection to the scheme as modified by the Bombay Government whereby the sub-centre at Ahmedabad was dropped; as a matter of fact, this was not in his original scheme, but had been introduced at the instance of the Provincial Research Committee. Mr. Devadhar supported the scheme. He said that the work already done in the Bombay Deccan on the subject had produced very beneficial results for a particularly needy section of the population. There were other areas in India where rainfall was scanty and not too well distributed and for all these a scheme like the present one would be of great utility. Mr. Sethi said that they had similar problems in the United Provinces and he thought that they should have sub-centres in the United Provinces as well as in the Punjab. Mr. Collins said that the collaboration

of Hyderabad had been invited to this scheme. His Government were very willing to offer all the assistance they could. The conditions of three districts on the western frontier of Hyderabad were similar to those of the districts on the eastern border of the Bombay Presidency. While Hyderabad was not in a position at present to start a new sub-centre, the State was prepared to give all the necessary facilities at the agricultural station recently started at Raichur. His Government had one suggestion to make, which was that an advisory committee of representatives from the areas affected should meet from time to time and discuss problems of common interest; a suggestion which Mr. Main said that he welcomed. Mr. Hilson thought that the better utilisation of rainfall was really the problem. Madras had fourteen centres where the problems which Mr. Main had stated in his note circulated to the Advisory Board were being dealt with. Madras, however, was not unique, as he felt sure other provinces were doing the same. He was therefore of opinion that the Agricultural Expert Adviser to the Council should collect information as to what was being done on the subject in the provinces and indicate the way in which the Imperial Council could assist this research. Mr. Devadhar said that the results obtained from work already done were being applied in some districts in the Deccan. He mentioned that there were 44 centres in the district of Ahmednagar mostly opened by the Agriculturists themselves with the advice of the department. In the districts of Poona, Sholapur, and Bijapur there were 5 Centres in each and the results at most of these places were very satisfactory. Mr. Plymen said that the problem was one in which his own province would like to join, but that they did need an investigation as to what was being done in other provinces. He was in favour of a committee like the Fertilizers Committee which should not only survey the whole position but which would collate the results of past experiments. Mr. Burt said that as stated by previous speakers, the problem was the condition of crop growth in areas of scanty rainfall, such areas, for example, as had a rainfall below 20 inches per annum most of which fell in a short period of time, say for example 10 days as in certain places in the Bombay Deccan. He conceived the problem as largely a Deccan problem, in which Bombay, Hyderabad, the Ceded Districts of Madras and portions of the Central Provinces were concerned. He was of opinion that the Council should support a scheme in so far as the central station was concerned, but should not provide sub-stations in any of the provinces. He did not think that a better place could be found for a central station than had been proposed, namely, Sholapur. The staff proposed by Mr. Main for the central station was not excessive, but care should be taken that the chief investigator was thoroughly suited for his job as this was essential to the main scheme. Mr. Devadhar supported Mr. Burt and added that in his opinion this was a vital problem for the Deccan. Dr. Hyder said that the Deccan was not the only scanty area to be considered. He instanced the Salt Range in the Punjab. Dr. Keen supported the idea of a committee. While reading through the vast amount of literature which existed on the conservation of soil moisture, he found very little reference to the experiments in India. He therefore felt that past records should be examined and all the necessary information collated as a preliminary. He noticed that in Mr. Main's scheme which was a very sound one, the soil aspect of the problem had been emphasised. The same aspect had been stressed in the sugarcane research scheme in the Bombay Deccan and he considered it rightly so. Mr. Milne supported Mr. Main's scheme (Appendix XXX) but was in favour of the

appointment of a committee which should consider the requirements of barani districts of the Punjab. Dr. Hyder and Mr. Carpenter were both in favour of a committee which should examine such schemes and co-ordinate them somewhat as the Sugar Committee had done with the sugar schemes. At this stage Dr. Keen moved the following resolution :—

It was seconded by Mr. Carpenter.

“That a committee be formed for the purpose of examining the general, technical and scientific position with reference to farming in areas of limited rainfall and in the first instance to examine the Bombay dry-farming research scheme.”

Mr. Main had no objection to the above resolution which was agreed to by the Board. Selection of members of this committee was left to the Chairman.

10. *Research on the water requirements of crops.* (Subject No. 29 of the agenda) (Appendix XXVI).—After Mr. Milne had explained the scheme the Board decided to refer it to the Committee appointed for subject 28 (Appendix XXX).

Scheme for research on Plant Physiology at the Hindu University, Benares. (Subject No. 35 of the agenda) (Appendix XXXII).—The Board decided to refer this scheme to a committee. The personnel of this committee was left to the Chairman.

11. *Proceedings of the first meeting of the Fertilisers Committee held in June 1940.* (Subject No. 30 of the agenda) (Appendix XXXIII).—Mr. Burt invited the attention of the Board to the statement showing the recommendations made by the Fertilisers Committee at its first meeting held in June 1940. The Board supported the action recommended in regard to the means by which indigenous manures may be cheapened and their use extended. The Board agreed to the recommendations of the Committee in connection with further research in regard to the possibilities of indigenous manures especially to unirrigated tracts and to tracts with defective irrigation facilities. In particular, on the motion of Mr. Plymen, seconded by Mr. Carpenter, the Board recommended that the Council in giving grants should make it a condition that the general principles enunciated by the Committee governing the planning and interpretation of experiments should be followed in respect of all experiments financed as a result of such grants.

12. *Preliminary report on the calorific value of some Indian woods.* (Subject No. 31 of the agenda) (Appendix XXXIV).—Noted.

13. *Arrangements for the examination by specialists of papers for publications in the new Journals and the preparation of a list of referees.* (Subject No. 32 of the agenda) (Appendix XXXV).—Dr. Hyder said that no provision had been made for referees in the subject of Agricultural Economics and recommended that such provision should be made. Mr. Burt said that he agreed that this should be done, but he explained the reason why it had not been done before was that they had never so far received any paper on agricultural economics. The Board recommended on the motion of Mr. Plymen that Dr. Hyder and Mr. Darling should be appointed as referees for papers on Agricultural Economics and Prof. Ganguli should be added to the list of referees on general Agriculture.

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11. *World's Grain Exhibition and Conference, Canada, 1932.* (Subject No. 33 of the agenda) (Appendix XXXVI).—The Board decided that six weeks from hence should be allowed for suggestions from members as to the subjects on which papers should be sent from India to the Conference and the authors who should be invited by the Council to contribute papers.

15. *Revision of the Publications "Dictionary of the Economic Products of India" and "The Commercial Products of India".* (Subject No. 54 of the agenda) (Appendix XXXVII).—In regard to the Dictionary of the Economic Products of India the Board agreed with Mr. Burt that it was very doubtful if a revised edition would be justified. It would cost some two or three lakhs of rupees, and as would be the case with all encyclopedias, it would soon be out of date. As regards the Commercial Products of India, the Board recommended on the motion of Mr. Burt, that subject to the Council not being involved in any financial liability, a revision of this publication should be undertaken. It would probably be necessary to have one editor with a number of specialists collaborating with him. If the Government of India agreed to such a revision, it was recommended that a sufficient number of copies should be printed so that copies may be available for at least five or six years thereafter. The Board also considered that it would be as well to print parts dealing with plants and animal products separately from the one dealing with mineral products. The desirability of a good index as well as of giving vernacular equivalents accurately was also emphasised.

16. *Rice Research. Proposal for the establishment of a research station in the United Provinces.* (Subject No. 4 (a) of the agenda) (Appendix V).—Mr. Burt moved and Mr. Pinlow seconded the adoption of the Report of the Rice Committee. The Board agreed.

17. At the special request of Mr. Collins a scheme (Appendix XXXVIII) submitted by Hyderabad for an extension of research work on castor already being carried out by the State Department of Agriculture so as to add to its utility for other parts of India was circulated to members of the Board. It was decided to postpone consideration of this scheme till the next meeting of the Advisory Board as it had come too late for inclusion in the agenda and Members had had no time to study it.

18. The Chairman in adjourning the Advisory Board, thanked members for the sustained interest which they had shown in the discussion of a heavy agenda and for the valuable advice which they had given. The work which they had accomplished during the five days they had sat would be fruitful of results for which they would be gratefully remembered in time to come.

Mr. Devadhar in moving a vote of thanks to the Chairman, which was unanimously carried, paid a tribute to the tact, patience and sympathy with which he conducted the proceedings.

The proceedings then terminated.

M. S. A. HYDARI.

16th January 1931.

APPENDIX I.

DECISIONS OF THE GOVERNING BODY ON THE RECOMMENDATIONS OF THE ADVISORY BOARD MADE AT ITS MEETING IN JUNE 1930.

- (1) *Extracting, summarising and publishing material on the research and experimental work carried out by the Imperial and Provincial Agricultural Departments in India.*—The proposal for the production of a semi-popular book on the lines of "Research and the Land" reviewing the results of agricultural and veterinary research in India for the past 25 years was approved.
- (2) *Grant for research work on water hyacinth by Professor Parja at Cuttack.*—Sanctioned.
- (3) *Award of prizes and medals for improvements in Agriculture and Animal Husbandry.*—Accepted.
- (4) *Establishment of a sub-station of the Botanical Section of the Pusa Institute at Karnal.*—The scheme as recommended by the Advisory Board but with the addition of Rs. 10,000 for equipment was sanctioned.
- (5) *Appointment of a Research Officer at the Imperial Institute of Veterinary Research to investigate into the condition known as contagious abortion among domestic animals.*—Rejected.
- (6) *Proposal for the appointment of a Protozoologist at the Imperial Institute of Veterinary Research, Muktesar.*—Approved.
- (7) *Appointment of a Research Officer for equine diseases at the Imperial Institute of Veterinary Research.*—Rejected.
- (8) *Appointment of a special officer for the investigation of Tuberculosis and Johne's disease among animals.*—Approved.
- (9) *Financial assistance in aid of the scheme to establish a Veterinary Institute in the Central Provinces.*—The Governing Body accepted the recommendation of the Advisory Board that the proposal as it stood was hardly such as could be considered.
- (10) *Recommendations of the Locust Committee (2nd meeting) (a) Locust research in India, (b) contribution of £500 per annum for 5 years towards the cost of the Empire Scheme of Locust research to be carried out by the Imperial Bureau of Entomology.*—The Governing Body agreed to a unified locust research scheme at a total expenditure not exceeding Rs. 1,76,000. As regards (b), the Governing Body were against the proposed grant on the information before them. The Vice-Chairman of the Council undertook, during his visit to London, to obtain further information on the subject.
- (11) *Contribution to the Imperial Bureau of Entomology.*—The Governing Body decided that a grant not exceeding £100 per annum should be made.
- (12) *Establishment of a Bureau of Agricultural Intelligence in India.*—Accepted subject to detailed estimates of cost being submitted in due course for the Governing Body's sanction.
- (13) *Appointment of a committee to investigate the subject of mechanical cultivation in India.*—Approved subject to the proviso that the personnel of the Committee should be revised by the Hon'ble the Chairman and the Vice-Chairman of the Council to provide for the representation thereon of businessmen and other non-officials interested in mechanical cultivation.
- (14) *Scheme for the establishment of a new branch of Agricultural Meteorology under the Indian Meteorological Department at Poona.*—Sanctioned at a total cost of Rs. 41,000 per annum or Rs. 2,05,000 for 5 years.

(15) *Schemes for rice research in (a) the Central Provinces, (b) Burma, (c) Bihar, (d) Assam, (e) Bengal and (f) Madras.*—The Governing Body accepted in principle the recommendations of the Advisory Board in respect of the schemes; but decided that, before sanctioning estimates of expenditure in detail on any individual scheme, enquiries should be made from the Empire Marketing Board as to what contribution the Board was prepared to make towards these schemes.

(16) *Invitation to the Govt. of India to participate in the World's Grain Exhibition and Conference to be held in the City of Regina in the Province of Saskatchewan (Canada) from the 25th July to 6th August 1932.*—The Governing Body agreed that India should participate in this Exhibition.

(17) *Proposal to set up a Committee to consider the development of the Indian Oil Crushing Industry*—Approved subject to the proviso that the personnel of the Committee should be revised by the Hon'ble the Chairman and the Vice-Chairman of the Council to provide for the representation thereon of businessmen and other non-officials interested in the oil crushing industry.

(18) *Application for a grant-in-aid for the experiments in the utilization of sewage for manurial purposes by different methods conducted by the Nagpur Sewage Farm.*

(19) *Financial assistance to the National Horse Breeding and Show Society of India.*—The Governing Body accepted the recommendation of the Advisory Board that both these applications should be rejected.

(20) *Scheme for research into properties of colloid soil constituents to be carried out by Dr. J. N. Mukherjee, Khaira Professor of Chemistry, University of Calcutta.*—Accepted.

(21) *Scheme for statistical investigations on experimental errors in field trials to be carried out by Mr. P. C. Mahalanobis, Professor, Presidency College, University of Calcutta.*—Accepted.

M. S. A. HYDARI,

Secretary.

Dated 4th December 1930.

APPENDIX II.

LETTER FROM SIR FRANK NOYCE, KT., C.S.I., C.B.E., I.C.S., SECRETARY TO THE GOVERNMENT OF INDIA, DEPARTMENT OF EDUCATION, HEALTH AND LANDS, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 1820-AGRI., DATED SIMLA, THE 6TH SEPTEMBER 1930.

SUBJECT :—*Question of the expansion of the Imperial Institute of Agricultural Research, Pusa, as an educational centre.*

I am directed to invite the attention of the Imperial Council of Agricultural Research to the recommendations made by the Royal Commission on Agriculture in India in paragraphs 60 and 480 of their Report in regard to the expansion of the Pusa Institute as an educational centre and in paragraphs 15 and 551 regarding the formulation of a scheme for research scholarships and also for scholarships for post-graduate training for district work.

2. In paragraph 60 of the Report it was specially recommended that the advice of the Council of Agricultural Research as to the lines on which the present facilities for post-graduate research at Pusa should be expanded should be taken as soon as possible after its constitution. To enable the Council to be in a position to express an opinion on the subject, the Government of India considered it desirable that Provincial Governments should first formulate their views in regard to the recommendations in question and in their letter No. 1215-Agr., dated the 23rd/27th July 1929 (copy of which is enclosed), they accordingly informed the local Governments and Administrations that the Government of India were prepared to accept the view of the Royal Commission that India should become self-sufficient in the matter of higher agricultural training at an early date and that the organisation of the Pusa Institute as a centre of post-graduate study should be proceeded with. They also expressed their willingness to provide all the facilities required as rapidly as financial conditions permitted but added that they were unable to agree with the view of the Royal Commission that whether or not candidates for the New Superior Provincial Agricultural Services take the course of post-graduate study, which they consider an essential qualification for admission to those Services, the organisation of the Pusa Institute as a centre of post-graduate study should be proceeded with. They held the opinion that the extent to which the existing facilities at Pusa should be extended and improved must depend upon the extent to which the Provincial Governments were prepared to make use of the facilities so provided and they asked the latter for a definite indication of their views on this point.

3. The replies from local Governments—copies of which are enclosed—reveal a large measure of agreement with the recommendations of the Royal Commission as modified by the Government of India in their letter of 23rd July 1929, referred to above. It will be seen from these replies that although the majority of local Governments cannot undertake that the completion of a post-graduate course at the Pusa Institute shall be an essential qualification for appointment or promotion to their New Superior Provincial Agricultural Services and few of them are able to give an indication of the number of men whom they will wish to send annually for training at Pusa, there is a general consensus of opinion that the facilities provided at the Pusa Institute will be fully utilised but that the latter will first have to establish its reputation as a centre for post-graduate training. The only dissentient to this view is the Government of Bombay, who think that they will have little or no occasion to send men to Pusa for training.

4. The Government of India consider that, though the information obtained from the local Governments in regard to the extent to which they will make use of the increased facilities provided is not quite as definite as could be wished, their replies furnish sufficient justification for acceptance of the recommendation of the Royal Commission that the Pusa Institute should be made a centre for post-graduate training. The Government of India, have, therefore, decided to accept this recommendation and propose to provide the necessary facilities as rapidly as financial conditions permit. To enable them, however,

to proceed with the matter, they would be glad to have detailed information as to the type of courses which the provinces require and, if possible, to have a definite answer to the following questions :—

- (a) Is definite post-graduate instruction, as distinct from facilities for research work, desired in all the subjects dealt with at the Pusa Research Institute ?
- (b) Is there a need for a special post-graduate course at Pusa designed for future Assistant and Deputy Directors of Agriculture, as distinct from the specialist courses in special branches of agricultural science ? If so, should the special course for Assistant and Deputy Directors be largely in the nature of a refresher course in science and in the technique and interpretation of field experiments designed for men whose initial training has been largely in agricultural colleges and who have had considerable subsequent experience in practical agriculture ?
- (c) What will be the general standard of scientific and technical knowledge which candidates recommended by Provincial Departments of Agriculture will have attained prior to entering on their post-graduate course ?

I am to request that the advice of the Imperial Council of Agricultural Research may be obtained on these points and furnished to the Government of India as early as possible. On receipt of the recommendations of the Council, the Government of India propose to instruct the new Director of the Pusa Research Institute to frame proposals for the reorganisation of that Institute in such a manner as will provide for adequate post-graduate training in agricultural science of the highest type.

5. Another point on which the advice of the Imperial Council of Agricultural Research will be welcomed by the Government of India is the question of the class of students which should be admitted to the Pusa Research Institute for post-graduate training. For the reasons stated in paragraph 2 of their letter No. 1215-Agr., dated the 23rd/27th July 1929, to local Governments referred to before, the Government of India considered that if Pusa is to fulfil its proper function of training the best men available for service in the Imperial and Provincial Agricultural Departments as envisaged by the Royal Commission, the students admitted to it should consist in the main of the following two classes :—

- (a) Men selected on their University or College record and sent to the Pusa Institute with a scholarship with a view to qualifying for a definite appointment or, at any rate, for immediate admission to an Agricultural Department.
- (b) Class II Service men selected with a view to immediate or ultimate promotion to Class I.

It was assumed that private students would either be very few in number or non-existent. It will be seen from the replies of the local Governments that whilst they agree with the classification suggested above there is also general agreement amongst them that while the post-graduate course at the Pusa Research Institute should not be closed to private students, students nominated by local Governments should have preference and should form the majority. Honours graduates of Indian Universities are likely to provide in increasing degree the staff required for research appointments in the provincial agricultural departments and it does not appear desirable to limit the admission to Pusa of such graduates to those who actually gain scholarships. There also appears no objection to the admission of private students recommended by local Governments who would be likely to obtain suitable employment if they completed the course satisfactorily, provided their academic qualifications were suitable.

6. Finally I am to invite the attention of the Imperial Council of Agricultural Research to the recommendations made by the Royal Commission on Agriculture in paragraphs 45, 549 and 551 of their Report, in connection with the formulation of a scheme for research scholarships and also for scholarships for post-graduate training for district work and to request that early steps may be taken to formulate a scheme in consultation with local Governments and others concerned.

LETTER FROM G. S. RAJPAI, Esq., C.I.E., C.B.E., I.C.S., SECRETARY TO THE GOVERNMENT OF INDIA, DEPARTMENT OF EDUCATION, HEALTH AND LANDS, TO ALL LOCAL GOVERNMENTS AND ADMINISTRATIONS, No. 1215-AGRI., DATED SIMLA, THE 23RD/27TH JULY 1929.

I am directed to invite attention to the recommendations made by the Royal Commission on Agriculture in India in paragraphs 60 and 480 of their Report in regard to the expansion of Pusa as an educational centre. The Royal Commission consider it essential that India should become self-sufficient in the matter of higher agricultural training at an early date. They are further of opinion that the completion with credit of an approved course of post-graduate study should be regarded as an essential qualification for admission to the New Superior Provincial Agricultural Services, whether for service in the districts or for research work in the agricultural colleges. They hold that, in existing conditions, the only institution in India in which facilities for post-graduate study in all branches of agricultural science can be provided is the Agricultural Research Institute at Pusa. They, therefore, recommend that the organisation of Pusa as a centre of post-graduate study should be proceeded with.

2. The recommendations of the Royal Commission under this head received the unanimous support of the Conference convened at Simla in October last to consider the recommendations of the Commission. The Government of India are prepared to accept them and to provide all the facilities required for higher agricultural training at Pusa as rapidly as financial considerations permit, but they are unable to agree with the view of the Royal Commission that, whether or not candidates for the New Superior Provincial Services take the course of post-graduate study which they consider an essential qualification for admission to those services, the organisation of Pusa as a centre of post-graduate study should be proceeded with. It appears to them that the extent to which the facilities for post-graduate study, which already exist at Pusa, should be extended and improved must depend upon the policy which Provincial Governments decide to adopt in regard to the recruitment of their New Superior Agricultural Services. I am to point out that the fourteen students, who were taking post-graduate courses at Pusa in 1928-29, were, with few exceptions, private students or officers of the Subordinate Agricultural Services, who were taking the courses with a view to bettering their prospects in the Agricultural Departments. The Government of India are inclined to doubt whether it is desirable that men should be permitted or encouraged to go to Pusa for post-graduate training in the vague hope of bettering their prospects, if they already hold a post in a Provincial Agricultural Department, or of securing an appointment in the Department, if they do not. The result must inevitably be a large proportion of disappointments, partly because, under the present system, some of the men selected are not really up to the standard required for post-graduate training and partly because appointments are often not immediately available in the branch of agricultural science in which they have specialised. A defect which is inherent in the present system is that there is frequently a lengthy interval between the termination of the Pusa course and the securing of an appointment in an Agricultural Department and that, during this interval, the value of the training given at Pusa rapidly diminishes. It was with a view to the removal of these defects that the Royal Commission, in paragraph 519 of their Report, recommended that Provincial Governments should institute a system of scholarships for candidate for admission to their New Superior

Provincial Agricultural Services similar to that which the Imperial Agricultural Conference of 1927 recommended should be instituted for the new Colonial Scientific Service. These scholarships would be awarded to graduates selected as possessing the kind of qualifications required and should be of sufficient value to maintain the scholar whilst he was obtaining the post-graduate qualifications the Royal Commission indicated as essential. The Royal Commission added that the possibility that a scholar might prove undesirable would have to be faced and that, in such circumstances, the scholarship should be terminated and the expense written off without hesitation. In other words, they anticipated that the post-graduate students at Pusa would be men for whom there were definite openings in the Provincial Departments of Agriculture but that whether appointments were eventually filled by the men designed for them would depend on their work during the period of post-graduate training. Although the Royal Commission held that the completion with credit of an approved course of post-graduate training should be regarded as an essential qualification for admission to the New Superior Provincial Agricultural Services, whether for service in the districts or for research (including teaching) work in the agricultural colleges, they laid down no hard and fast rule as to the stage of his career at which a man should undergo this training. As regards research and teaching work, they definitely contemplated promotion in cases of merit from Class II to Class I appointments and, as regards district work, they held that a considerable number of the vacancies in Class I appointments on the administrative side should be filled by the promotion of Class II officers. In these circumstances, it is clear that if the views of the Royal Commission are accepted and if Pusa as an educational centre is to fulfil its proper function of training the best men available for service in the Imperial and Provincial Agricultural Departments, the students admitted to it for post-graduate training should consist in the main of two classes. The first of these would consist of men selected on their University or college record and sent to Pusa with a scholarship with a view to qualifying for a definite appointment or, at any rate, for immediate admission to an Agricultural Department. The second would consist of Class II men selected with a view to immediate or ultimate promotion to Class I. Private students would either be very few in number or non-existent. The Government of India are of opinion that it is only by the adoption of the system outlined above that Provincial Governments will be placed in a position to frame an estimate of the number of men for whom they will require places reserved at Pusa and that they themselves will be in a position to decide the extent to which the facilities for higher agricultural training at Pusa should be extended and improved. They propose to refer the whole question to the Council of Agricultural Research, as it will be for that body, in pursuance of the recommendations of the Royal Commission in paragraphs 45 and 551 of their Report, to formulate a scheme for research scholarships and also for scholarships for post-graduate training for district work. In order that the Council of Agricultural Research may be able to take up the question at an early date, the Government of India consider it desirable that Provincial Governments should formulate their views in regard to it, with the least possible delay. I am, therefore, to ask that the Government of Madras, etc will be good enough to examine the question in the light of the considerations pointed out in this letter, and to furnish the Government of India with ^{you} their _{your} opinion on it as soon as possible.

No. 1216-Agr.

Copy forwarded to the Agricultural Adviser to the Government of India.

LETTER FROM V. N. MEHTA, Esq., I.C.S., M.L.C., SECRETARY TO THE GOVERNMENT, UNITED PROVINCES, DEPARTMENT OF AGRICULTURE, NO. 750-A., DATED THE 22ND AUGUST 1929.

With reference to Mr. Bajpai's letter No. 1215-Agr., dated July 23, 1929 (Agri. A., July 1929, No. 87), I am directed to say that this Government will wel-

from the organization of Pusa as a centre of post-graduate study. The proposals made in Mr. Bajpai's letter appear to contemplate that it will be open only to men with definite prospects of employment in the Superior Provincial Agricultural Service, or to men already in Government service. At the present time numbers of Indian students go to England and elsewhere for higher agricultural training, some at their own expense and some with Government scholarships, without any definite promise of employment. This Government understood the Royal Commission's proposal to be that Pusa should be so developed as to attract these, and provide them with the type of instruction which they require, under Indian conditions. The extent to which this could be done would of course depend entirely on whether the teaching and equipment at Pusa was brought up to a standard equivalent or superior to that of the institutions abroad to which they now go, and more in consonance with the requirements of Indian agriculture—an element often lacking in the training of students educated abroad. Its success as a higher training centre must depend on its own merits, and the reputation which it acquires. On that will also depend the extent to which this Government would be prepared to make it the sole training ground for their higher agricultural service, in continuation of the course at the Agricultural College, Coimbatore. The extent to which they can substitute post-graduate training at Pusa for post-graduate training abroad will depend on this, and on the opinion which may be formed of the quality of the training at Pusa by the Provincial Legislative Council. The number of appointments likely to be available will also depend on the attitude of the Provincial Legislative Council to the expansion of the activities of the Department of Agriculture. The Government anticipate at present an annual recruitment to Class I of the Provincial Service of two or three officers per annum for the next five years; but the conditions governing appointments are such that no definite guarantee of employment is given at present to State scholars when these are sent to England, or could be given if these were sent to Pusa. This Government would, therefore, on the whole, prefer that Pusa should organize itself strictly as an institution for giving post-graduate training to a certain number of men deputed by each province in accordance with the number of seats assigned to it. This number will include (a) selected employees of the present provincial agricultural service who may be deputed for further training generally or in special or selected branches, (b) students to whom posts will be guaranteed, if they pass successfully through a special course at Pusa and (c) certain graduates who have been recommended but to whom no guarantee of employment has been made.

LETTER FROM THE HON'BLE MR. A. N. L. CLARKE, I.C.S., OFFICIATING CHIEF COMMISSIONER, AJMER-MERWARA, No. 434-CC/29, DATED THE 22ND AUGUST 1929.

With reference to letter No. 1215-Agr., dated the 23rd July 1929, from the Government of India in the Department of Education, Health and Lands, I have the honour to state that the system outlined in the letter referred to above seems to me suitable and may be adopted.

LETTER FROM B. K. GOKHALE, ESQ., I.C.S., OFFICIATING SECRETARY TO GOVERNMENT OF BIHAR AND ORISSA, EDUCATION AND DEVELOPMENT DEPARTMENT, No. 650-D.R., DATED THE 5TH SEPTEMBER 1929.

I am directed to say that the Government of Bihar and Orissa in the Ministry of Education agree with the views expressed by the Government of India in Mr. Bajpai's letter No. 1215-Agr., dated the 23rd July 1929, that if Pusa as an educational centre is to fulfil its proper function of training the best men available for service in the Imperial and Provincial Agricultural Departments, the students admitted to it for post-graduate training should consist in the main of two classes. The first class would consist of men selected on their University or College record and sent to Pusa with a scholarship with a view to qualifying for a definite appointment or at any rate, for immediate admission to an

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Agricultural Department. The second would consist of class II men selected with a view to immediate or ultimate promotion to class I. Private students would either be very few in number or non-existent.

2. The local Government consider that one of the most important points to be considered in connection with the framing of a course of studies should be the general standard of Scientific education and agricultural knowledge of probable future applicants. Any men sent from Bihar and Orissa would be science graduate (B.Sc.) selected from the Arts and Science Colleges, taken in a probationers in class II and sent to Pusa after they have spent one or two years on an experimental farm. The local Government have arranged to send two men annually to the Agricultural College at Nagpur and they propose to make the same arrangements at Cawnpore. But unless and until they have an agricultural college of their own, it will not be possible to ensure that all the men sent to Pusa will have taken a degree course in an Agricultural College.

3. The local Government hope that the adoption of this system will ensure their men being properly trained and qualified to carry on efficiently the research, teaching and district work of the Agricultural Department. Considering the very small cadre of the Provincial Agricultural Department, both in class I and class II, and the probable wastage, the local Government expect that they will require an average of only one seat to be reserved annually for their men at Pusa.

4. In pursuance of the recommendations of the Royal Commission in paragraphs 45 and 551 of their Report, the Imperial Council of Agricultural Research will, it is hoped, formulate a scheme for research scholarships and also for scholarship for post-graduate training for district work and arrange to finance these scholarships from their own funds.

LETTER FROM THE HON'BLE SHI NOMIN BOHON, K.C.I.E., C.S.I., I.C.S., CHIEF COMMISSIONER, N. W. P. PROVINCE, No. 1740 Rev. N., DATED NATHANAGAL, THE 21ST SEPTEMBER 1929.

I have the honour to say in reply to your letter No. 1215 Agri., dated the 23rd July 1929, that it is unlikely that it will be possible to send a student often more than once in ten years from this Province. It seems open to question whether it is more desirable that the post-graduate course should be taken before or after definite appointment to a Provincial Service.

FROM S. V. RAMAMURTY, Esq., I.C.S., SECRETARY TO THE GOVERNMENT OF MADRAS, DISTRICTS DEPARTMENT, No. 2902-M-29-2, DATED FORT ST. GEORGE, THE 10TH OCTOBER 1929.

With reference to Mr. Bajpai's letter No. 1215-Agri., dated 25th July 1929, I am directed to state that this Government are in agreement with the opinion of the Royal Commission that the completion with credit of an approved course of post-graduate study should be regarded as an essential qualification for the new Superior Provincial Service. Under existing conditions the Agricultural colleges in India are not in a position to provide the intensive training which is necessary to fit men to fill the higher posts in the Agricultural Department and it is therefore desirable to have some Institute in India where such training can be provided. This Government consider that though Pusa as at present constituted cannot provide the post-graduate courses which will be required by different Provinces, it can safely be left to the Council of Research to so organize Pusa that it can meet at any rate part of the demand.

2. This Government also consider that it is possible that certain courses which will be required by Provincial Governments cannot be taught satisfactorily at Pusa. For example, a Province may desire an officer to take a post-graduate course in the cultivation of paddy or cotton instead of a general course in Agriculture or plant genetics. Pusa may not be able to teach such courses. Such training should, in the opinion of this Government, be provided in the Provincial

Agricultural Colleges. These courses would, however, be under the aegis of the Pusa Institute and facilities and possibly financial help would have to be provided to enable the Colleges to undertake the work. This aspect of the question will need careful examination by the Council of Research.

3. This Government consider that students deputed to Pusa by Provincial Governments with or without scholarships may be given preference over private students.

4. In conclusion I am to state that the number of students from this Province for whom seats will have to be reserved at Pusa every year will be communicated to the Government of India later on.

FRANCIS A. R. MORRIS, Esq., I.C.S., SECRETARY TO THE GOVERNMENT OF BURMA,
FOREST DEPARTMENT (MINISTRY OF FORESTS), No. 268-O. 29, DATED MAY 10,
THE 5TH OCTOBER 1929.

In reply to your letter No. 1215-Agril., dated the 23rd July 1929, I am directed to say that the Government of Burma (Ministry of Forests) is in agreement with the principle of the recommendation of the Royal Commission on Agriculture that the Agricultural Research Institute at Pusa should be reorganised as a centre of post-graduate study in all branches of agricultural science. If this reorganisation is carried, the Ministry hopes to be able to make use of the facilities offered for post-graduate study, but it regrets that it is unable to make any estimate of the number of officers that are likely to be sent annually from Burma for post-graduate course.

2. The number in any case is likely to be small. At present there are only 14 posts in the Class I Service. The number may be increased but it is impossible to say when the increase will take place or what number of posts will be added to the Service. Moreover the standard of education among students at the Agricultural College at Mandalay is comparatively low, and graduates of that College even if they underwent a post-graduate course at Pusa would not ordinarily be fit for direct appointment to the Class I Service. It is true that every now and then if there are impending vacancies in the posts of Agricultural Chemist, Botanist or Mycologist, it may be possible provisionally to select for the vacancies an exceptionally brilliant honours graduate from the Nanyang University and to send him for post-graduate training to Pusa. But the Ministry anticipates that it may be necessary to fill for sometime to come the majority of vacancies for direct recruits in the Class I Service by recruitment in England, and such recruits will ordinarily take post-graduate courses in England. The rules however provide that 20 per cent of the posts in the Class I Service should be filled by promotion from the Class II Service and the Local Government has considered whether a post-graduate training should not be an essential pre-requisite to such promotion. But the Director of Agriculture points out that generally speaking the posts of Deputy Director will be filled by promotion of this kind and that the men selected for promotion will be men who have earned promotion by long experience and knowledge of district work. He doubts whether post-graduate training would be useful for such men, and the Local Government is disposed to agree. It is not aware that special courses of study could suitably be arranged for officers who will be employed in district work. But the point is one which will no doubt be considered by the Council of Agricultural Research, and the Local Government is willing to reserve its final opinion.

3. The position of the Governor of Burma acting with his Ministers therefore is that while it is in sympathy with the recommendation of the Royal Commission, he does not think that he will be able to make very much use of the proposed post-graduate courses and he is quite unable to frame any estimate of the number of students likely to be sent from Burma.

FROM F K KHAN, ESQ., B.A., LL.B, UNDER SECRETARY TO GOVERNMENT,
CENTRAL PROVINCES, No. 792-530-XIV, DATED NAGPUR, THE 17TH OCTOBER
1920.

I am directed by the Government of the Central Provinces (Ministry of Agriculture) to refer to Mr. Bajpai's letter No. 1215-Agri, dated the 23rd July 1920, inviting the views of the Central Provinces Government on the extent to which the facilities for higher agricultural training at Pusa should be extended and improved.

2 In reply I am to say that this Government is in sympathy with the view that India should become self-sufficient in the matter of higher agricultural training but it agrees that the extent to which the facilities for post-graduate study, which already exist at Pusa, should be extended and improved must depend upon the policy adopted by provincial Governments in regard to the recruitment of their new superior agricultural services. With reference to this aspect of the case, this Government entirely accepts the view that it is not desirable that candidates should be permitted or encouraged to enter Pusa for post-graduate training unless they have a definite appointment waiting for them at the conclusion of their course. Thus the students ordinarily admissible for post-graduate training at Pusa would be confined to two classes, namely—

- (1) candidates selected for, and sent with, scholarships with a view to qualifying for a definite appointment in the agricultural department, and
- (2) officers of the lower branch of the provincial service who have been selected with a view to immediate or ultimate promotion to the superior service.

3 As regards the estimate of the number of places which this Government would require to be reserved for its candidates at Pusa, I am to say that this Government has in the past deputed a few officers to Pusa for training in chemistry, bacteriology, entomology and botany, and it will continue to depute officers for this training in future. Also, while Pusa is not likely to be in a position to offer training in what may be termed the 'extension' and 'district work' of provincial agricultural departments, it considers that the agricultural research institute could profitably assist in the training of candidates for the agricultural service by providing post-graduate courses in economics, agricultural statistics and modern experimental methods, and this Government would be prepared to take full advantage of such assistance. There is, however, considerable difficulty in framing any definite estimate of the demands it is likely to make on the facilities available at Pusa. It is realised that unless recruitment to the superior agricultural services is practically confined to men trained at Pusa, there may be less justification for providing the expensive staff and equipment required for training the comparatively few men to be recruited in the superior agricultural services, and the question may arise whether the limited number of botanists, chemists and similar experts required could not be secured equally satisfactorily and at less cost by awarding scholarships to selected candidates for training in existing institutions abroad. While full allowance is made for this consideration, this Government would prefer not to confine its recruitment to men trained at Pusa, so as to exclude altogether candidates who have obtained their training in the required subjects at their own expense and who are fully qualified for its service, though other things being equal it would be prepared to give preference to locally trained candidates. At the same time the number of candidates to be recruited and for whom training may be required depends on the rate of development of the department, which in its turn is determined by financial circumstances over which the department has no control. In view of the above considerations this Government regrets that it is unable at this stage to frame any definite estimate of the number of candidates it would be likely to depute for training at Pusa in the event of the facilities at the institute being extended to meet all the requirements for the training of candidates for the superior branch of its agricultural department.

LETTER FROM J. W. SMYTH, Esq., I.C.S., SECRETARY TO THE GOVERNMENT OF BOMBAY, REVENUE DEPARTMENT, No. 3150-A.28, DATED BOMBAY CASTLE, THE 23RD OCTOBER 1929.

With reference to Mr. Bajpai's letter No. 1215-Agri., dated the 23rd July 1929, I am directed by the Government of Bombay (Transferred Departments) to state that they endorse the view expressed in paragraph 28 of the Royal Commission on Agriculture in India regarding the utility of Pusa as a centre of higher education in Agriculture. They, however, consider that Pusa cannot compete with overseas institutions for post graduate training. In this Presidency so far no difficulty has been experienced in securing overseas trained men for service in the Agricultural Department. The number of men prepared to go abroad for higher training at their own expense is also increasing. During the course of this year two graduates of the Poona Agricultural College have returned from abroad with overseas qualifications, and two members of the Bombay Agricultural Department have proceeded to Europe for further study. Considering the small number of appointments that fall vacant in the Bombay Agricultural Service the Government of Bombay feel that they will have little or no occasion to send men to Pusa for training. This being the case, they cannot endorse the policy of the development of Pusa as a post graduate institution, even though this proposal has behind it the support of the Agricultural Commission.

LETTER FROM LIEUTENANT-COLONEL C. T. C. PLOWDEN, I.A., SECRETARY OF THE HON'BLE THE AGENT TO THE GOVERNOR-GENERAL IN BALUCHISTAN, No. 5416-R, DATED QUETTA, THE 4TH NOVEMBER 1929.

With reference to your letter No. 1215-Agri., dated the 23rd July 1929 and subsequent reminder, I am directed to state that the views of this Administration will be submitted as soon as an agricultural officer is appointed in this province, vide my letter No. 5001-R., dated the 21st September 1929.

LETTER FROM H. G. DIXON, Esq., I.C.S., SECRETARY TO THE GOVERNMENT OF ASSAM IN THE TRANSFERRED DEPARTMENTS, EDUCATION DEPARTMENT, No. 2726-E, DATED SHILLONG, THE 5TH NOVEMBER 1929.

I am directed to refer to your letter No. 1215-Agri., dated the 23rd July 1929, and to say that the Government of Assam have not yet formulated a scheme for the development of the agricultural department or come to any conclusion about the organization of the new superior provincial agricultural service. They regret therefore that it is not possible at present to state the policy which they would adopt as regards recruitment, or to reply to the specific points detailed by the Government of India.

LETTER FROM S. V. RAMAKRISHNA, Esq., I.C.S., M.L.C., SECRETARY TO THE GOVERNMENT OF MADRAS, DEPARTMENT DEPARTMENT, No. 2902-III/29-3, DATED FORT ST. GEORGE, THE 12TH NOVEMBER 1929.

In continuation of paragraph 4 of my letter No. 2902-III/29-2, dated the 10th October 1929, I am directed to state that this Government are not in a position at present to say how many men they will be able to send to Pusa in future years.

LETTER FROM THE HON'BLE SIR JOHN THOMPSON, K.C.I.E., C.S.I., I.C.S., CHIEF COMMISSIONER, DELHI, No. 9056-R. & A., DATED DELHI, THE 22ND NOVEMBER 1929.

In reply to Mr. Rahim's letter No. 2015-Agri., dated the 13th November 1929, I have the honour to say that the proposals contained in Mr. Bajpai's letter No. 1215-Agri., dated the 23rd July 1929, involved the question of selecting

men for training in P. A. The selection would be made from two sources, (1) from those already in service and (2) from University graduates. The first of these would not concern the Administration, which has no Agricultural Service of its own and consequently depends on officers borrowed from the Punjab. As regards the second class, no candidates from the small Provinces are not likely to be found. I have made enquiries from the Government of the Punjab as to whether that Government will be willing to include candidates from Delhi in the scheme drawn up by them.

I await their reply.

Yours truly, G. P. Hogg, Esq., M.A., 1888, SECRETARY TO THE GOVERNMENT OF INDIA, AGRICULTURE AND FORESTRY DEPARTMENT, No. 6016, NEW CALCUTTA, 2ND 10-11th December 1923.

I am directed to refer to Mr. Bhopal's letter No. 1215-Agril, dated the 24th July 1923. The Government of India propose to refer the whole question to the Council of Agricultural Research. In the meantime they desire to have the opinion of the local Government in regard to it.

2 In reply, I am to say that the Government of Punjab are in general agreement with the opinion of the Royal Commission on Agriculture that the combination with credit of an approved course of post-graduate study should be regarded as an essential condition for admission to the North Western Provinces Agricultural Service, and that, in carrying out this policy, the only institution in India in which facilities for such a post-graduate study can be provided is the Agricultural College in P. A. At the present time they came in the view of the Government of India that it is not desirable to permit or encourage any of the subordinate agricultural services or private students to go to P. A. for post-graduate training in the absence of having their prospects for securing an appointment in the department. This Government therefore, is of the opinion that the better course would be to send selected students to the Agricultural College in P. A. up to the point where there are difficulties in the department. The selection of students would, of course, depend on the quality of students during the period of post-graduate training. In the case of other services, it is proposed to provide for a lower course, the Government would also arrange to provide places in P. A. for a post-graduate course.

3 As regards the size of the number of men for whom places should be reserved at P. A. and the proposed system of recruitment, I am to say that it is not feasible at the present time to furnish any definite estimate of average annual recruitment or the number in the service. Much will depend upon the degree of expansion of the province's agricultural department. The probable number of vacancies within the next few years will be very small. It is not, therefore, possible to put down a definite figure.

Yours truly, M. M. G. Langer, Esq., 1888, SECRETARY TO THE CHIEF COMMISSIONER OF COORG, No. 3417-21 (1), BANGALORE, 2ND DECEMBER 1923.

I am directed to refer to your letter No. 262-Agril, dated the 24th December 1923, and to say that the Chief Commissioner is not yet in a position to give a definite reply to Mr. Bhopal's letter No. 1215-Agril, dated the 24th July 1923, though he recognizes that it is one of the first importance to the Province and it is under active discussion with the Commissioner of Coorg.

2 I am, however, to explain some of the difficulties with which the Province of Coorg is faced. The Province is small and its financial resources are very limited; on the other hand its resources lie entirely in the land, that is to say, in plant (tea, rice and coffee) and forestry, while animal husbandry calls urgently for attention.

The Province cannot by itself afford an Agricultural Service, but there are disadvantages, financial, technical and administrative, in borrowing officers either from the Government of India or Government of Madras.

But in any case the Province is unlikely to be able to afford more than a single officer of comparatively low rank, so that its needs will hardly affect any decision that the Government of India may come to regarding the expansion of Pusa as an educational centre.

LETTER FROM A. C. MACNABB, ESQ., I.C.S., SENIOR SECRETARY TO THE FINANCIAL COMMISSIONER, AND DEPUTY SECRETARY TO GOVERNMENT, PUNJAB, DEVELOPMENT DEPARTMENT, No. 1492-D., DATED LAHORE, THE 9TH APRIL 1930.

With reference to the correspondence ending with your letter No. 2360-Agr., dated the 24th December 1929, I am directed by the Punjab Government (Ministry of Agriculture) to intimate that in the draft rules for the new Class I Agricultural Service, experience of research work has been entered as one of the qualifications for administrative posts, while for research posts the qualification proposed is as follows:—

“recruitment will be made from amongst candidates who possess a University degree with honours or other similar qualification in the special science concerned, and preference will ordinarily be given to those who have spent at least two years in research work under a scientist of established reputation, and have studied the science from an agricultural point of view.”

In this rule, however, no special mention is made of Pusa, as so many candidates from India now proceed to England for training, and the Punjab Government does not propose to exclude these entirely. But it will be clear that if Pusa provides facilities for training in research it should become the chief training ground for candidates educated in India.

2. The appointments are to be made (both direct and by promotion from class II) on the advice of either the Public Services Commission of the Government of India, or of a provincial Commission, if one is constituted; so that it will be for this body to decide whether it will accept training in research at any other place in India except Pusa as a qualification under the rule.

3. It will be seen that if a member of the class II service aims at promotion to a research post in class I he will have to undergo at least two years in research work to qualify.

4. Of the officers in the department, many have done post-graduate work in various institutions, of whom four have worked at Pusa and five at Bangalore, so that the staff in this province have shown willingness to profit from the facilities afforded by the Government of India, and if these facilities are extended as proposed it may confidently be anticipated that yet more use will be made of them.

LETTER FROM J. N. G. JOHNSON, ESQ., C.I.E., I.C.S., OFFICIATING CHIEF COMMISSIONER, DELHI, No. 4911-R. & A., DATED DELHI, THE 27TH MAY 1930.

In continuation of my predecessor's letter No. 9956-R. & A., dated the 22nd November 1929, I have the honour to refer to letter No. 1492-D., dated the 9th April 1930, from the Senior Secretary to the Financial Commissioners and Deputy Secretary to Government, Punjab, Development Department, to the Under Secretary to the Government of India, Department of Education, Health and Lands, and to say that for the reasons indicated in Sir John Thompson's letter No. 9956-R. & A., dated the 22nd November 1929, the decision of the Punjab Government will be accepted by this Administration, which depends on the Punjab for its agricultural staff. Candidates from this Administration would enter the Punjab Agricultural Service and would have to comply with the requirements in force in the Punjab; and therefore the conditions which are accepted by the Punjab should apply to candidates from Delhi.

APPENDIX III.

The Minutes of the first meeting of the Committee appointed to consider the Pusa Training Prospectus held on the 12th February 1922, the Agricultural Adviser presiding.

PRESENT :

Messrs. Howard, Harrison, Hutchinson, Henderson, McRae, Fletcher, Mann, Clouston, Sampson, Dobbs, Evans, Coleman, Townsend, Parr and Clague and Burt (Secretary)

The prospectus of the Agricultural Research Institute and College as drafted two years ago was laid before the meeting as also a note on "Post-graduate training in Agriculture" by Mr. and Mrs. Howard.

The Agricultural Adviser in introducing the subject said that the Committee would continue on Wednesday, if necessary. The Government of India had decided on a course of training at Pusa to qualify for appointment to the Indian Agricultural Service. The present syllabus has been drawn up by his predecessor and the Government of India had directed that the syllabus should be considered by a Sub-Committee of the Board of Agriculture. He referred to the representative character of the Committee and the number of its members who had at some time been themselves Deputy Directors of Agriculture.

He considered that it would be better to start by considering the course of training required and then proceed to draw up a scheme and rough syllabus.

The object was to provide a substitute for the sending to England of Indians for training prior to appointment to the I. A. S. It was therefore essential that we should give an opportunity for students to get at Pusa as good a training as in England and they must be able to compete successfully with the latter at the end of their training.

He proposed that they should first consider the training necessary for the Deputy Directors of the future as this was the most difficult to arrange. The training of specialists was less difficult as they could be attached to the various sections.

The President then asked for the views of the different members of the Committee as to the kind of training necessary.

In reply to a question from Dr. Mann the President stated that this was a definite scheme for providing men for the I. A. S.

Mr. Sampson inquired whether provision would be made for the training of men already in a Provincial Agricultural Service as well as the men recruited direct from colleges, to which the Chairman replied that provision for such men would be made.

Mr. Townsend inquired if properly qualified private students would be admitted and was informed that this would depend on the number of vacancies in the course.

Further discussion elicited the fact that in most provinces it was anticipated that appointments to the I. A. S. would largely be made from men who had already proved their capability in the provincial agricultural service rather than by direct recruitment from Provincial Agricultural Colleges, followed by a special course at Pusa.

Mr. Sampson enquired as to what would happen in the case of men who had gone to England for training at their own risk and not been selected for the I. A. S. by the Secretary of State. He pointed out that there are already a number of such men in the country seeking employment.

Mr. Clouston enquired as to whether the Selection Committee for candidates to be recommended to the Secretary of State for the I. A. S. would continue and whether this would not meet Mr. Sampson's point. Mr. Howard pointed out that responsibility for the appointments in future might rest more with local Governments rather than the Selection Board. The Chairman pointed out that if a local Government recommended one of its officers for promotion to a post in the I. A. S. the Government of India would invariably send that recommendation to the Secretary of State with their own opinion. The Agricultural Adviser also pointed out that for the Imperial Agricultural Service men must be selected who would be suitable for transfer from one province to another. It was, therefore, necessary that any course of training should be of a high standard. Dr. Mann stated that in future the Bombay Government would probably not appoint men to the Indian Agricultural Service (as Deputy Directors) unless they had already had long service. Direct appointment after a college course followed by a special course would not suit Bombay.

In reply to a question by Dr. Parr it was agreed that students who pass the Pusa Course would probably have to enter the Provincial Agricultural Service in a province in the first place.

Mr. Dohbs pointed out that the present prospectus was really a relic of the proposal to provide for direct recruitment to the I. A. S. Dr. Mann pointed out that the course required at Pusa was apparently primarily a course to qualify men for Provincial Agricultural Services. Dr. Parr pointed out that the Provincial Agricultural Service was largely recruited from the subordinate Agricultural Service and hence Dr. Mann's proposal involved providing that men who originally entered the subordinate agricultural service from provincial colleges would have an opportunity of working their way up to the Indian Agricultural Service.

Mr. Clouston pointed out that the Government of India some time ago asked all provinces to improve the standard of their agricultural colleges so as to enable them to teach up to the standard necessary for direct appointment to a Provincial Agricultural Service.

Mr. Sampson pointed out that men who started in the subordinate agricultural service and whom it might be subsequently wished to promote to the Provincial Agricultural Service were frequently lacking in initiative and authority. A course of higher training would help to correct this. Dr. Mann stated that he was in favour of sending his best Subordinate Agricultural Service men to Pusa for training for their Provincial Service, but he would not send any man straight from college.

The Agricultural Adviser pointed out that the meeting seemed to be agreed that they were opposed to direct appointment to the Indian Agricultural Service (as Deputy Directors) of men trained in India, and that except in very special cases all appointments should be by promotion from the provincial agricultural services. Dr. Mann stated that what the Bombay Government really required was a strong provincial service to enable them to gradually do without an Imperial Agricultural Service.

Dr. Parr and Mr. Sampson pointed out that the Secretary of State might still appoint direct Indians who have gone to England for training. It was suggested in discussion that this could be met by insisting on such men being sent to Pusa for a course in Tropical agriculture. Mr. Evans pointed out the danger of parochialism as some provinces were very backward. Dr. Coleman agreed that higher appointments should be filled by the promotion of experienced men. Mr. Townsend agreed in general with the opinions expressed, but wished to emphasise that the Selection Board at Pusa was a useful body in maintaining a general standard.

DISCUSSION.

The Agricultural Adviser pointed out that the meeting seemed to agree that "it is desirable that posts of Deputy Directors should be filled, if possible, from men who have already served the Department in India. Students returning from England should be required to take a course in tropical agriculture at Pusa".

Dr. Parr thought they could not exclude the Secretary of State's selections.

The Agricultural Adviser explained the present procedure when a post in the Imperial Agricultural Service is to be filled. Enquiry has first to be made in India if a suitable officer is available before the Secretary of State is asked to take steps to fill the appointment from England. Mr. Sampson and Dr. Coleman pointed out that the requirement that officers appointed by the Secretary of State to take a course of tropical agriculture at Pusa might necessitate a change in the probationary period. Dr. Parr was not in favour of interfering with the present method of recruitment from England, but for recruitment in India utilise the Pusa course. He considered that men appointed by the Secretary of State in England would frequently be best sent direct to a province.

Dr. Mann and Mr. Clouston also expressed a preference for men trained in England being sent direct to the province in which they have to serve.

Mr. Dobbs suggested that the course at Pusa should be made permissive for men recruited in England. Mr. Sampson disagreed, as Indians trained in England often came out without real training in practical agriculture. It was finally agreed that for students trained in England a course in tropical agriculture at Pusa on arrival should be permissive at the option of the local Government concerned. As amended the Committee's resolution read—

"It is desirable that posts of Deputy Directors should be filled, if possible, from men who have already served the Department in India. Officers appointed from England direct might be required to take a course in tropical agriculture at Pusa during their probationary period".

The Committee then passed on to the consideration of the course of training required. The Agricultural Adviser said that there seemed to be agreement that it was necessary to frame a course suited to a man who was a graduate of a provincial agricultural college and who had proved a success in the subordinate agricultural service (either as a farm Manager or District officer) whom the provincial Director proposed to select for the gazetted service. Dr. Mann agreed.

Mr. Evans thought it necessary that such men should come to Pusa before they were 30 years of age. This would give them 5 to 6 years in the subordinate agricultural service. Mr. Townsend agreed.

Dr. Mann said that in his opinion the Deputy Directors of the future would be largely propagandists. Dr. Parr and Mr. Evans disagreed as they considered that he would have much experimental work to do. Dr. Mann said that to his mind the principal object should be to widen the man's view of the possibilities of improvement.

Mr. Sampson and the Agricultural Adviser pointed out that the improved status of a man who had been through a higher course of training was of administrative importance. Mr. Clouston said that experimental work was essential to successful propaganda. Dr. Parr wished to emphasise the importance of the experimental side. Dr. Mann said he thought it was sufficient if they could ensure men bring good farmers. After further discussion it was agreed that men were required who had enjoyed a better training, more specialised on definite lines and with a wider outlook. Dr. Parr pointed out that what was wanted was men thoroughly experienced in the principles of experimental work and capable of taking up independent lines of work on their own. This was accepted. Mr. Evans said that it was essential that men should be taught to appreciate exact experimental methods. This was accepted.

Mr. Clouston emphasised that Pusa could give facilities not available in provinces for a further study of crop improvement, agricultural machinery and breeding.

Mr. Townsend thought it should be made clear that the course proposed would be for men whom it may be proposed to promote from the subordinate to the provincial agricultural service but who eventually might be destined for the Imperial Service. Dr. Mann pointed out that the Pusa course should be a hallmark for men applying for promotion to the Imperial Service.

After discussion the Committee endorsed the recommendation of page (2) of the draft prospectus amended to read as follows :—

"Agriculture.—The aim is to provide for a general post-graduate course of the highest possible standard in Indian and tropical agriculture. *Except in very special cases* the only candidates who will be admitted to these courses are students who have passed creditably through a full course in a provincial agricultural college. All students must have been recommended by the local Government as suitable for further post-graduate training".

Mr. Dobbs pointed out that Bihar had now no college and that they proposed to take science graduates, employ them as Farm Overseers and Farm Managers and then promote them to the Provincial Service. He enquired if such men would be admitted to the Pusa course.

The Agricultural Adviser said that a definite undertaking could not be given. It might be possible to try one or two men of this class and see if they could follow the work of the course, but possibly the solution of Mr. Dobbs' difficulty would be to send men to an agricultural college in another province.

Mr. Henderson emphasised the necessity of adequate physique in men recruited for training in practical agriculture. It was decided that this could be left to the Local Governments.

LENGTH OF THE COURSE.

It was agreed that the proposed course of two years was too long and that one year was possibly the maximum for which local Governments would be prepared to send their men. Mr. Sampson pointed out that the students admitted would all have passed a college course of University standing.

Dr. Mann stated that Bombay experience of sending men to England was that it was inadvisable to send young men for a long course and they were now sending older men for one year for training on definite lines.

In reply to questions the Agricultural Adviser explained that as regards dairying Mr. Smith (the Imperial Dairy Expert) expected that there would be dairy schools at work shortly.

It was agreed that the length of the course should be one year. Students sent by provinces would ordinarily be on deputation and it was desirable that there should be uniformity in respect to any extra allowances paid to them over and above their ordinary pay.

SCHEME OF TRAINING.

Dr. Mann disagreed with the proposed syllabus and said that he thought they should consider the question as falling into two principal subjects, (1) Plant Industry, (2) Animal Husbandry; each treated as a whole. The officers in charge of these sides of the work at Pusa should decide what definite piece of work a man sent for training should take up. He emphasised the necessity for men of the class which he proposed to send being allotted a definite piece of work. He did not want a course involving a number of lectures and demonstrations by various sections.

Mr. Townsend did not consider any general course necessary with the possible exception of mechanics.

Dr. Mann emphasised that Pusa should have two definite sides, one devoted to Plant Industry and the other to Animal Husbandry and that men sent to Pusa for training should be put to work on a special problem under the direction of one officer. Mr. Evans thought that the training should be more general. Mr. Howard drew attention to the note which he had circulated which largely met Dr. Mann's point. Dr. Parr considered that in a few years' time Deputy Directors will have very little botanical work or plant selection work to do as the provinces would have Crop Specialists working on all the important crops. He thought that a specialised course as laid down in section (6) of the draft syllabus would meet the case. He thought that Deputy Directors in future should specialise on soils and their management; in some provinces they were now arriving at a point where the cultivation of new varieties could not be taken up without soil study. Mr. Howard thought that Dr. Parr's point was covered by his note and that physiological work such as root studies would meet the point.

Mr. Dobbs pointed out that soils presented an essentially local problem. Mr. Sampson stated that practical work on a farm was required. It was necessary to make their men farmers. The province sending men for training should decide as to what special subjects their men should be trained in as each province had its own problems. He thought that the training required would be covered by work on plant breeding or agricultural botany plus section (6) of the draft prospectus. Mr. Evans thought that they had to train Deputy Directors who would be connecting links between specialists and the public. Dr. Parr emphasised that original work by Deputy Directors would be necessary for many years to come. Mr. Fletcher urged the necessity for refresher courses. Dr. Mann again urged the necessity of men being put on to study special problems. He did not want lecture course.

The Agricultural Adviser in reply to a question said that the appointments of an Agronomist and an Agricultural Engineer had been sanctioned.

Mr. Townsend thought that a general course was desirable combined with a study of special problems as suggested by Dr. Mann. He emphasised the importance of the sub-section on Farm Management and Accounts. A number of members did not agree that there was any necessity to teach farm accounts at Pusa.

Dr. Coleman agreed with Mr. Evans, he emphasised the importance of sub-section 2 of section (6) of the draft prospectus. He entirely disagreed with Mr. Fletcher's proposal for refresher courses. Mr. Clouston suggested that sections 2 and 6 of the draft prospectus would meet their requirements section 2 being taken to mean plant industry and not a course of lectures in agricultural botany. Dr. Parr stated that he would particularly emphasise sub-sections (i) and (ii), i.e., Soils and Manures and the Technique of agricultural experiments.

It was agreed that a preliminary year on the farm was unnecessary and that students should proceed direct to the special courses. Mr. Sampson pointed out that the various sub-sections in (6) i.e., (i) soils and manures, (ii) technique of agricultural experiments, (iii) Farm equipment, (iv) Farm Management and accounts, (v) livestock, (vi) Prime movers, implements and machinery should be optional. A man should not be expected to take them all. Personally he thought it would be sufficient if a man took Agricultural Botany and sub-sections (i), (2) and (4) and possibly (5) of section (6).

Dr. Parr stated that he doubted whether it would be possible to arrange for men to study special subjects without arranging some kind of course. Dr. Mann again emphasised that he did not want to send men for courses of lectures. He did not object to occasional lectures provided they were very good.

Mr. Sampson enquired whether it would be possible to provide for work on Agricultural Economics. Mr. Evans agreed as to the importance of economics with particular reference to agricultural co-operation. The opinion of the Committee was that men competent to conduct a course in agricultural economics were not available in India.

Mr. Dobbs said that of the courses proposed under sections (2) and (6) practically everything except sub-section (vi) (Prime movers, implements and machinery) would have already been learnt in the provinces. He was in favour of training men in special subjects. He thought a general course would be of very little use.

The provincial representatives agreed that the proposed lecture courses in Agricultural Chemistry, Mycology, Entomology, and Bacteriology were unnecessary. It was decided that as the requirements of the various provinces differed widely the Committee should adjourn until Wednesday to enable members to discuss the matter informally in the meantime.

As regards the length of the course, Mr. Henderson asked the Committee to consider whether it would be possible to compromise on an 18 months' course so as to include a complete cycle of operations on the farm and a complete six months' for plant industry work.

The Committee then adjourned until Wednesday, February 15th, at 2 p.m.

The Minutes of the 2nd meeting of the Committee appointed to consider Pusa Teaching Prospectus held on February 15th at 2 p.m., the Agricultural Adviser presiding.

PRESENT :

Messrs. Howard, Hutcheson, Harrison, Henderson, McKee, Fletcher, Mann, Clouston, Sampson, Dobbs, Evans, Coleman, Townsend, Parr, Clague, A. G. Birt and Burt (Secretary).

Mr. Sampson at the request of the President laid a proposal before the meeting that men should start with a training in Farm Management including "Animal Husbandry" under the Imperial Agriculturalist and that after six months the course should be divided so as to suit the needs of the different provinces. Students would then either continue Farm Management and Animal Husbandry or would take up a six months' course of Plant Industry or a six months' course of Agricultural Engineering and Agricultural Machinery. In the case of a man who wished to take both Plant Industry and Agricultural Engineering, arrangements would have to be made either to extend his training to 18 months or to depute him again later.

In answer to a question by Mr. Clouston it was explained that all the Pusa experts would assist in teaching the courses.

A question was raised whether students should be accepted direct from Provincial Agricultural Colleges or whether previous experience on provincial farms should be insisted on. It was agreed—

"That a minimum of two years' experience on a Provincial Farm, after leaving the College, was essential before a student took up the 'Pusa course'."

Dr. Parr asked for details of the Plant Industry course and Dr. Coleman of the Farm Management and Animal Husbandry courses.

Mr. Sampson said that his idea was that a student would be attached to the Imperial Agricultural section to be trained in practical work including definite instruction, but not necessarily the lectures. Mr. Howard said that he proposed to take Crops as a subject including the growing of crops, Plant selection, testing of varieties and seed production.

Messrs. Henderson and A. G. Birt emphasised the advantage of a full year on the farm before taking up Plant Industry.

Mr. Howard said that he would have no objection. Dr. Parr said that he would make the bifurcation optional, i.e., he would leave each province to itself if the students were to study six months longer and take Plant Industry course.

Mr. Dobbs said that he would be more inclined to omit the general farm course and attach more importance to Plant Industry. Dr. Mann agreed with Mr. Dobbs.

The Agricultural Adviser said that perhaps the Farm Management course must be optional for the first six months, owing to the three special divisions—

- (1) Plant Industry,
- (2) Agricultural Engineering,
- (3) Animal Husbandry,

and suggested that any province might choose any of the three subjects for their students.

Dr. Coleman and Dr. Parr said that they would like to be clear that the rest of the Pusa staff would co-operate, as for example, by giving a certain number of lectures on soils, and manures. Mr. Dobbs suggested a division in the four subjects. In the first six months a student would take up Farm Management or Plant Industry; in the second six months either Agricultural Engineering or Animal Husbandry.

Mr. Sampson said that the Farm Management should be compulsory.

Dr. Parr suggested that what was required was a full year's course of the highest possible standard on the lines of Section 6 of the draft Prospectus, Plant Industry to follow this and be optional.

Mr. Clouston attached more importance to Plant Industry than to the other subjects and would make Agricultural Engineering or Animal Husbandry optional.

Dr. Mann said that he would agree to two of the three groups, Agricultural Engineering, Animal Husbandry and Plant Industry.

Mr. Sampson said that to his men he would make six months on the farm compulsory. Their men were not farmers and their training in the Agricultural Colleges and on experimental farms was not sufficient.

Mr. A. G. Birt agreed as to the weakness of their men in practical agriculture.

Mr. Clague said that he would make the farm course compulsory.

After further discussion it was agreed that the course of studies should be divided into three groups. Each student would take two of these groups and the course in each group would occupy about six months.

Group I.—Animal Husbandry, including land management, Fodder crops, Manures, storage of fodder crops, feeding of animals, etc.

Group II.—Plant Industry.

Group III.—Agricultural Engineering including Agricultural machinery, part of the time being spent in farm.

It was then considered whether Group I should be compulsory. It was decided that it was unnecessary, but that it should be recommended to all provinces that their students should take this group.

The Agricultural Adviser then asked the provincial representatives to explain what subject they would like included in the Farm Engineering course, as they had not yet an Agricultural Engineer at Pusa. The following subjects were provisionally suggested :—

- (1) Water lifts.
- (2) The Alignment and discharge of drains.
- (3) Pumping Installations.
- (4) Contour Surveying.
- (5) Prime Movers.
- (6) Irrigation by small power plants.
- (7) Tractors.
- (8) Agricultural implements.
- (9) Farm buildings.
- (10) Well sinking and boring.
- (11) Measurement of water discharges.
- (12) Embankments for the prevention of erosion.

The Committee then proceeded to the discussion of the course (B) Special Science courses.

Dr. Mann said that he would like to emphasise again the agricultural aspect and the importance to students of an agricultural outlook. There was a distinct danger of their outlook being narrowed to that of particular sides instead of being attracted to broader agricultural aspects of the problem. It was agreed that this might be made clear in the preamble to the Prospectus.

CONDITIONS OF APPOINTMENT.

Condition (1) of the Prospectus was accepted.

In regard to condition (2) Dr. Harrison and Mr. Hutchinson explained the necessity for ordinary University Graduates taking a year in an Agricultural College to learn Agricultural chemistry before taking a post graduate course in their subjects, otherwise the students' time at Pusa would be wasted for elementary work which would have been learnt elsewhere.

Condition (2) was amended by substitution of the words "Recommended by the Director of Agriculture of the Province" for "Recommended by the Principal of the College".

Condition (3) was omitted as unnecessary.

Condition (4) was accepted.

Syllabus.—It was agreed that the courses given in the printed Prospectus were out of date and unsuitable. It was decided that men would be sent to Pusa to be associated with the work of a section and to undertake a definite piece of work, as training in research methods. The length of the course would depend on the man and the piece of research work on which he was engaged. It was agreed that a minimum period should be one year which might be extended to a maximum of two years, as required.

Certificates.—It was agreed that certificates should be given that the student had attended the course and done satisfactory work.

It was agreed that it should be emphasised that this course should be made as good a qualification for the Indian Agricultural Service as a post-graduate course in England.

Library.—It was agreed that it might be necessary to duplicate sectional libraries so that all books should be readily available to all advance students.

APPENDIX IV.

ESTABLISHMENT OF AN ENLARGED ANIMAL NUTRITION INSTITUTE
AT DEHRA DUN.

Attention is invited to the attached letters Nos 3409 and 3568, dated respectively, the 27th May and 2nd June 1930, from the Director, Imperial Institute of Agricultural Research, Pusa, on the above-mentioned subject. The Physiological Chemist, Bangalore, who has worked out the scheme estimates its cost at Rs. 1,46,000 non-recurring and Rs. 71,500 per annum recurring; in order to arrive at the net extra cost a further Rs. 3,000 per annum on account of "Director's allowance" should be subtracted from the estimate of recurring expenditure, as this is not likely to be sanctioned if the scheme materialises. The estimates are, however, incomplete as they do not include the cost of the farm to be attached to the Institute for which no site has yet been selected. The Government of India would however in the meantime be grateful for the views of the Advisory Board as to the necessity for such an Institute and the scope of the work it could do.

M. S. A. HYDARI,

Secretary.

The 15th December 1930.

ENCLOSURE I.

LETTER FROM THE DIRECTOR, IMPERIAL INSTITUTE OF AGRICULTURAL RESEARCH, PUSA, TO THE SECRETARY TO THE GOVERNMENT OF INDIA, DEPARTMENT OF EDUCATION, HEALTH AND LANDS, No. 3409, DATED THE 27TH MAY 1930.

Establishment of a Central Research Institute for Animal Nutrition in India.

With reference to the correspondence ending with Mr. Rahim's letter No. 1021-Agri., dated the 25th April 1930, I have the honour to forward herewith, for necessary action, a scheme for converting the X-ray Institute at Dehra Dun into an Animal Nutrition Institute, as drawn up by Mr. F. J. Warth, Physiological Chemist. The estimates are based on plans worked out in full detail. The quantities involved in construction work have been calculated by a qualified engineer and the cost has been estimated mainly at rates prevalent in Bangalore.

2. The total non-recurring expenditure of the scheme is estimated at Rs. 1,46,000 of which Rs. 31,650 relate to construction and Rs. 96,100 to equipment. Mr. Warth proposes to have the works relating to construction and equipment done departmentally under the supervision of his First Assistant Mr. A. V. Iyer and Mr. Wilfred, a clerk of the Imperial Dairy Expert who has the qualifications of a draftsman. As apparently none of these officers has adequate technical knowledge of building operations and as the scheme involves electrical and water installations which, under para. 313 of the P. W. D. Code, have to be carried out through the agency of the Public Works Department, I think it would be preferable to have the construction works and those relating to electrical and water installations entrusted to the Executive Engineer, Imperial Works Division, Dehra Dun, on whose books the X-ray Institute is borne.

3. It will appear from the scheme that Mr. Warth has proposed for himself an additional allowance of Rs. 250 per mensem as Director of the Institute, I regret I am unable to support this proposal for the reason that the Institute will rank as a section of this Department and therefore, so far as I can see, will only stand in the same relation to the Director as other sections of it. Mr. Warth already draws the allowance admissible to the Heads of Sections of the Pusa Institute and there appears to be no reason for treating him preferentially.

4. A detailed statement of the present staff and the cost of the Physiological Chemist's Section as compared with the staff and the cost of the proposed Institute at Dehra Dun will follow as it has not yet been received from Mr. Warth.

INCLOSAR.

**Proposed Scheme for converting the X-ray Institute, Dehra Dun,
into an Animal Nutrition Institute.**

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„ No. VI. Existing Clerk's and servants' quarters to be converted into four quarters.	

EXPLANATORY NOTE.

1. *General.*—The present proposals are made on the understanding that a suitable cattle breeding farm attached to the institute and situated in the vicinity is deemed essential and will be provided in the near future.

The X-ray Institute is admirably suited for the scientific part of the work. In this connection the following points deserve special notice :—

- (a) The three main laboratory buildings can be used practically as they stand. It is proposed to spend no more than Rs. 750 on reconstruction in this part.
- (b) There is a large commodious block of stables which can be converted at relatively little cost (Rs. 2,500) into excellent nutrition stalls.
- (c) The adjacent old stables are conveniently situated for employment as preparation rooms in connection with the nutrition stalls.
- (d) Some of the existing store houses and the workshop are needed by the Nutrition Section and will be employed as they are at present.
- (e) There is a block of waste land, 14 acres in extent. This will provide space for small scale cropping and grazing experiments which have to be carried out under close laboratory control.
- (f) The difficult problem of finding quarters for the staff can be met by effecting alterations to existing buildings. It is estimated that ten quarters will be provided in this way at a cost of Rs. 16,000.

In short the main buildings, the permanent and subsidiary buildings, the extensive stables and the waste land will be useful for the Animal Nutrition Institute.

2. *Proposed utilisation of the buildings of the present X-ray Institute.*—All the existing buildings of the X-ray Institute are shown in the accompanying site plan (Plan No. I), in which a new serial number has been given to each building. The proposed utilisation of each building is shown in tabular form in Table I, which shows also the cost of reconstruction. It will be observed that with the exception of the water tower (item 15) no new building is to be erected. Existing buildings, suitably modified, will be used for the gas plant, the water pump and motor shed, the nutrition stalls, the preparation rooms for nutrition work, housing of weighbridge and on a relatively large scale for quarters. The expenditure on reconstruction is further classified in Table II (Summary of capital expenditure) where it will be seen that construction costs for the entire scheme are distributed as follows :—

				Rs.
(a) Laboratory adjuncts	..	..	..	8,050
(b) Nutrition work	..	..	..	5,000
(c) Quarters	..	..	..	16,000
(d) Drainage	..	..	..	2,000
				<hr/>
				31,650
				<hr/>

These estimates are based on the assumption that the work is to be carried out departmentally as follows :—

When construction is to commence, Mr A. V. Iyer, Senior Assistant to the Physiological Chemist, will be transferred to Dehra Dun, where quarters in the Institute are ready for him to occupy. He will supervise the construction of the laboratory adjuncts and the nutrition stalls. To assist him in technical matter

pertaining to building, it is proposed to place Mr. Wilfred, Draftsman in the office of the Imperial Dairy Expert and a qualified Engineer, on special duty for such time as may be necessary. The Imperial Dairy Expert has kindly consented to lend Mr. Wilfred for this work and we think he should receive an acting allowance of Rs. 50 per mensem while on this special duty.

The reasons for this proposal to carry out the reconstruction departmentally are as follows :—

(1) The construction connected with the laboratory adjuncts and the nutrition stalls is highly technical and should be under the entire control of the Nutrition Section.

(2) The construction connected with quarters consists of a number of petty works, which can be carried out with ease departmentally and are scarcely worth handing over to the Public Works Department, if the remainder of the work is retained in our hands.

(3) It is proposed to carry out the fitting up of the laboratory simultaneously with the construction. This is quite feasible as actual construction in the main laboratory buildings is not required. For this fitting up work Mr. Iyer will get valuable help and advice from Mr. Wilfred.

(4) The reconstruction desired by the Section is well understood by Mr. Wilfred, who has drawn up all the plans for this work under my direction and has worked out the quantities. As these two officers are available in the department, it is felt that the proposed arrangement cannot be improved upon for producing exactly what is required. It is estimated that the entire scheme of construction and equipment could be completed in six months.

3. *Equipment*.—The cost of equipment (summarised in Table II) is distributed as follows :—

	Rs.
(a) Laboratory, offices and laboratory adjuncts ..	74,200
(b) Nutrition work	9,200
(c) Electrical installation to laboratories, offices, nutrition stalls and quarters	6,000
(d) Water supply to laboratories, offices, nutrition stalls and estate	5,000
(e) Fencing of the estate	2,000
Total ..	96,400

Details under heads *a*, *c* and *d* are given in subsidiary estimates (Tables III, IV, V and VI). There is a certain amount of furniture at present in the Institute. Some of this could be made use of by the Nutrition Section if it is not required by the Medical Department.

4. *Total Capital expenditure*.—The capital expenditure summarised in Table II is distributed as follows :—

	Rs.
(a) Construction	31,650
(b) Equipment	96,400
(c) Transfer	14,500
(d) Miscellaneous and contingencies	3,450
Total ..	1,46,000

It should be noted that of the total expenditure, over Rs. 83,000 are devoted to the equipment of the laboratories and nutrition stalls.

Recurring Expenditure.

Assuming that the X-ray Institute at Dehra Dun will be taken over on 1st September 1930, the remaining six months of the current financial year will be occupied in carrying out the building operations and the equipment, items which are debitable to capital expenditure only, so that no extra recurring expenditure will be incurred during this financial year. For the financial year 1931-32, the extra recurring expenditure, consequent on the working of the enlarged Institute of Animal Nutrition at Dehra Dun, is estimated at Rs. 7,800 made up as follows :—

	Rs.
(a) Director's allowance at Rs. 250 per mensem ..	3,000
(b) Upkeep of roads and buildings	2,000
(c) Extra cost of fodder to maintain additional live stock	1,000
(d) One Mechanic and Assistant	720
(e) Care of Estate. Two Chokridars and Two Malis	648
(f) Sanitation. Three sweepers	432
Total	7,800

No special explanation appears to be necessary for any of these items with the exception of the personal allowance of Rs. 250 per mensem to myself as Director of the New Institute. It is hoped that in view of the increased scope of the work at Dehra Dun and the increased responsibilities entailed thereby, Government will consider this a reasonable demand especially in view of the fact that had I remained at Pusa, I would have received from time to time a similar allowance when acting as Joint Director.

The above items of recurring expenditure will be included in the budget estimates of the Section for 1931-32.

F. J. WARTH,
Physiological Chemist,
The Imperial Institute of Animal
Husbandry and Dairying, Bangalore.

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TABLE 1.—EXISTING BUILDINGS OF THE X-RAY INSTITUTE AND PROPOSED USE OF EACH.

No	Present designation.	Proposed use.	Cost of reconstruction.	Remarks.
1	X-ray Institute ..	Laboratory ..	Rs. 750	
2	Orthopedic Institute ..	Laboratory ..	..
3	X ray treatment block	Laboratory ..	..
4	Power-house and Workshop.	Dairy ..	..
5	Store room .. ..	..	..	A four-walled building without roof.
6	Store room ..	Water-pump power house.	100	Cost of foundation for motor and pump, cost of aperture for belt.
7	Wetting shed ..	..	..	This is a temporary structure.
8	Power house ..	Gas House ..	3,000	Including cost of foundation for furnace, retort and gas holders.
9	Temporary godown ..	..	..	A temporary structure.
10	Shed for workshop ..	Shed for workshop ..	..	A temporary structure.
11	....	..	..	Temporary structure.
12	Workshop	Workshop ..	..	Temporary structure.
13	Store room	Store room ..	..
14	Testing house ..	..	..	A semi-permanent building.
15	....	Water-tower ..	4,500	New structure.
16—22	Superintendent's Quarter with out-houses.	Physiological Chemist's quarters with out-houses.	..	
23—26	Quarters and Out-houses.	Quarters and out-houses	1,708	Total cost for quarters Rs. 15,313 or Rs. 16,000.
27	Rattary room ..	Quarters ..	2,837	
28	Cart shed and harness room	Two Quarters ..	4,020	
29	Hospital Assistant's Quarters	Quarters ..	500	
30	Clerk's quarters and Out-houses, and	Four Quarters	2,869	
31	Servants' quarters ..	..	3,381	
32—33	Boys' quarters ..	Servants' quarters ..	..
34	Old Stables	Shed for weighbridge, Nutrition apparatus and preparation room.	1,000 and 1,500	Including reconstruction and laying down foundations for weighbridges.
35	New Stables (Mule shed).	Nutrition stalls ..	2,500	Including reconstruction and flooring.
36—37	Store	Store .. ..	..
38—39	Chowkidars' quarters ..	Chowkidars' quarters ..	..

TABLE II.—SUMMARISED STATEMENT OF CAPITAL EXPENDITURE.
A. CONSTRUCTION.

1. Laboratory and Office.		Rs.	Rs.
(a) Gas plant housing, etc.	.. ..	3,000	
(b) Water-pump and motor housing ..	.. ..	400	
(c) Water-tower and tank .. ..	.. ..	4,500	
(d) Structural alterations .. ..	.. ..	750	8,650
2. Nutrition work.			
(a) Conversion of stables into cattle stalls ..	.. ..	2,500	
(b) Foundations for two weighbridges ..	.. ..	1,500	
(c) Conversion of old stables into barn and pie- paration room .. ..	.. ..	1,000	5,000
3. Quarters.			
Alterations and additions to existing buildings for conversion into quarters .. ..	.. ..	16,000	16,000
4. Drainage.			
Construction of drainage in the estate ..	.. ..	2,000	2,000
Total for construction ..			31,650
B. EQUIPMENT.			
1. Laboratory and Office.			
(a) Laboratory benches, Fume chambers, fume exhaust systems, office furniture, etc. ..	.. ..	34,600	
(b) Laying on of water and gas taps, pipes, sinks, drains, grids, etc. .. ..	.. ..	22,000	
(c) Purchase and erection of gas plant and water- pump .. ..	.. ..	15,600	
(d) Library books .. ..	.. ..	2,000	74,200
2. Nutrition work.			
(a) Purchase of livestock .. ..	.. ..	3,000	
(b) Equipment and furniture .. ..	.. ..	1,200	
(c) Two weighbridges .. ..	.. ..	5,000	9,200
3. Electrical installations in the laboratory, office, nutrition stalls, quarters, etc. ..		6,000	6,000
4. Water supply to the Estate		5,000	5,000
5. Fencing of the Estate		2,000	2,000
Total cost of equipment ..			96,400

C. TRANSFER.

		Rs.	Rs.
(a) Freight on apparatus, etc.	.. ..	6,500	
(b) T. A. of Officers and Staff	.. ..	8,000	14,500

D. MISCELLANEOUS.

(a) Allowance to the Draftsman, including his T. A. but excluding his salary	.. ..	500	
(b) Contingencies	.. ..	2,950	3,450
Total Capital Cost	.. ..		1,46,000

TABLE III.—LABORATORY BUILDINGS AND OFFICE FURNITURE

Block No. 1.

	Rs.
Dark Room and Ante room to the same. (Not fitted up)	
Office room	220
Assistants' room	350
Senior Assistant's room	145
Lecture room and Post Graduate students' Laboratory	2,060
Officers' rooms	655
General Office and record rooms	880
Library and Librarian's office	3,500

Block No. 2.

Special laboratory	3,144
Combustion and large apparatus room	1,430
Kjeldahl digestion room	2,525
Distillation room	400
Still room	200
Laboratory store	855
General laboratory	7,122
Balance room	830
Drying room	100
Preparation room	730
Sampling room	660
Sectional library	380

Block No. 3.

Special Laboratory	1,398
(Outside.)	
General store	1,500
Eleven Fume exhaust systems	3,500
Total	31,581
	or
	34,000

TABLE IV.

1. *Estimate of laying on gas piping and taps, water piping, taps and sinks in the laboratory.*—A detailed plan has been drawn showing every pipe, tap and sink required. From past experience it is estimated that the cost of purchase and fixing up will amount to about Rs. 17,000.

Contractor's estimates are not available at present.

2. *Estimate for construction of laboratory drains with grids, sumps and connections.*—A detailed plan has been drawn showing all drains.

From past experience it is estimated that the cost will be about Rs. 5,000.

Contractor's estimates are not available at present.

		Rs.
Estimated cost of piping, taps, etc.	..	17,000
Estimated cost of drains, etc.	..	5,000
		<hr/>
Total	..	22,000

TABLE V.—ELECTRIC SUPPLY FOR LABORATORY, NUTRITION STALLS AND QUARTERS.

	Rs.	Rs.
(a) For 10 big posts, main wires and 12 small posts	2,400	
(b) For ratle sheds, Barn and preparation room	200	
(c) For quarters, including cost of metres	2,300	
(d) For readjustment of points in the laboratory	1,100	6,000

TABLE VI.—LAY OUT AND COST OF WATER SUPPLY.

Washing and drinking supply.

	Rs.	s.	p.	Rs.
(a) 850 ft. 4" galvanised steel pipes	1,700	0	0	..
(b) 500 ft. 2" galvanised steel pipes	500	0	0	..
(c) 1,300 ft. 1½" galvanised steel pipes	975	0	0	..
(d) 1,750 ft. 1" galvanised steel pipes	637	8	0	..
(e) 36½" water taps	108	0	0	..
(f) Extra bends, angles, tees, etc.	500	0	0	..
(g) Labour and contingencies	570	8	0	5,000

APPENDIX V.

ESTABLISHMENT OF A RICE RESEARCH STATION IN THE UNITED PROVINCES.

Attention is invited to the attached letter from the Government of the United Provinces, No. 630-A., dated the 11th September 1930, in regard to the scheme for the establishment of a rice research station in Bareilly or Pilibhit District in the United Provinces. The scheme, which is explained fully in the Local Government's letter, involves a non-recurring expenditure of Rs. 1,45,950 on account of land, buildings and equipment, and Rs. 1,61,420 recurring spread over 5 years, or a total expenditure of Rs. 3,10,370. The scheme has been approved by the Provincial Agricultural Research Committee, which has recommended that the amount of Rs. 94,000 for land and buildings out of the non-recurring expenditure should be paid by the Council if the Local Government are unable to meet it. The scheme is for the consideration of the Advisory Board. In this connection, it may be noted that the Empire Marketing Board have been asked for financial assistance towards the cost of the various rice research schemes in accordance with the recommendation of the Advisory Board made at its last meeting held at Simla in June 1930 as approved by the Governing Body.

M. S. A. HYDARI,

Secretary.

The 2nd December 1930.

LETTER FROM THE SECRETARY TO GOVERNMENT, UNITED PROVINCES, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NO. 619-A., DATED THE 11TH SEPTEMBER 1930.

I am directed to forward, for consideration at the next meeting of the Imperial Council of Agricultural Research, a scheme, with detailed estimates of cost, which has been prepared by the Director of Agriculture, United Provinces, for the establishment of a rice research station in the United Provinces.

2. The area under rice in the United Provinces is about 7½ million acres and is 21 per cent. of the total cultivated area. Rice forms the staple food of 75 per cent. of the population of the provinces. During the last six years progress has been made with a preliminary classification and selection of good varieties from existing types; several promising varieties have already been distributed in the Surda Canal areas. The research work hitherto conducted touches, however, only the fringe of the vast field of work required on this important crop, but has reached a stage at which the establishment of a well equipped research and experimental station to start breeding work and to conduct further physiological experiments, for which valuable material has been collected, is essential.

3. The total cost of the scheme, spread over a period of five years, amounts to Rs. 3,10,370, the details of which are given in the two statements enclosed. The Imperial Council of Agricultural Research propose to ask the Empire Marketing Board to share between the two the financing of the rice research schemes submitted by the various provinces. I am therefore to request that the Imperial Council of Agricultural Research may be moved to sanction a grant to this Government of Rs. 3,10,370, spread over a period of five years to meet the cost of establishing and maintaining a rice research station in these provinces. I am also to say that the grant applied for can, if sanctioned, be accepted only on the clear understanding that its acceptance will not commit this Government to any expenditure in connexion with the scheme.

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*Cost of establishing a Rice Research Station in Barailly or Pilibhit District.***Recurring Expenditure.**

Items.	1st year.	2nd year.	3rd year.	4th year.	5th year.	Total five years.	Ultimate recurring cost.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1 Pay of officers—							
1 Assistant Field Specialist on Rs. 250—25—750	3,000	3,300	3,600	3,900	4,200	18,000	9,000
Total pay of officers ..	3,000	3,300	3,600	3,900	4,200	18,000	9,000
2. Pay of establishment—							
1 Farm Superintendent on Rs. 150—10—250	1,800	1,920	2,040	2,160	2,280	10,000	3,000
2 Research Assistants on Rs. 150—10—250 each	3,600	3,840	4,080	4,320	4,560	20,400	6,000
2 Fieldmen on Rs. 66—5—120 each	1,560	1,680	1,800	1,920	2,040	9,000	2,880
2 Laboratory Assistants on Rs. 30—8—60 each	720	792	864	936	1,008	4,320	1,440
2 Laboratory attendants on Rs. 12—2—24 each	288	336	384	432	480	1,920	628
1 Clerk and Storekeeper on Rs. 75—3—120	900	936	972	1,008	1,044	4,860	1,440
1 P. on Rs. 12	144	144	144	144	144	720	144
Total pay of establishment ..	9,012	9,618	10,224	10,820	11,596	51,420	15,132
3. Allowances—							
Travelling allowance	3,000	3,000	3,000	3,000	3,000	15,000	3,000
Total allowances	3,000	3,000	3,000	3,000	3,000	15,000	3,000
4 Supplies and Services—							
Running charges of Laboratory ..	3,000	3,000	3,000	3,000	3,000	15,000	3,000
Running charges of Experimental Station	8,000	8,000	8,000	8,000	8,000	40,000	8,000
Field Experimental Work	5,000	5,000	5,000	5,000	5,000	25,000	5,000
Total Supplies and Services ..	16,000	16,000	16,000	16,000	16,000	80,000	16,000
GRAND TOTAL	31,012	31,918	32,884	33,820	34,766	1,61,420	43,432

Cost of establishing a Rice Research Station in Bareilly or Pilibhit District.

Non-recurring.		1931-32.
Item.		Rs.
Land :—60 acres at Rs. 600 per acre	.. ..	36,000
Buildings :—		
(1) Laboratory .. ..	..	20,000
(2) Cattle shed .. ..	..	5,000
(3) Seed store and implement	.. ..	5,000
(4) Inspection House .. ..	..	10,000
(5) Superintendent's quarters	.. ..	5,000
(6) Assistant's quarters ..	..	5,000
(7) Farm servant's quarters	.. ..	3,000
(8) Lay out of farm .. ..	..	5,000
Total		58,000
Equipment :—		
(1) Implements and farm equipment	.. ..	4,550
(2) Bullocks, 6 pairs at Rs. 400	.. ..	2,400
(3) Tube well Rs. 12,000 ..	.. ..	12,000
(4) Fencing .. ..	..	3,000
(5) Equipment of laboratory	.. ..	10,000
(6) Gas plant .. ..	..	20,000
Total		51,950
Grand Total		1,45,950

Establishment of a Rice Research Station in the United Provinces.

The rice crop in the United Provinces occupies an area of about 7½ million acres. In normal years it exceeds the area covered by any other crop including wheat and is 21 per cent. of the total cultivated area. Rice forms the staple food of 75 per cent. of the population. The rice area in the United Provinces exceeds that of the Central Provinces, Benar, Assam, the Punjab and Bombay. There is a considerable trade in rice between the United Provinces and the neighbouring provinces and some of the fine varieties grown here are much in demand in other parts of Northern India.

The Economic Botanist to Government, United Provinces (Mr. R. L. Sethi) has specialised on botanical work on rice since 1924. It is proposed that he should continue in charge of the work which it is desired to expand in view of the importance of improving the rice crop in the Sarda Canal area by the cultivation of better quality and heavier yielding transplanted varieties in place of the poor qualities of broadcast rice now widely grown over the enormous rice area commanded by the Sarda. It is proposed that the research station should be situated in the Sarda area near either Bareilly or Pilibhit where excellent irrigation facilities exist, preferably near the former so that the superior staff can find accommodation in the Civil Lines. No immediate expenditure on residences is asked for beyond and inspection house on the experiment station for use when urgent work is in progress.

During the last 6 years headway has been made with the preliminary work of classification of and selection from existing types 1,200 samples of rice from all parts of the province have been examined and 135 types isolated which possess fixed and constant characters. Several promising types have already been distributed in the Sarda areas. Experiments conducted with methods of sowing, cultivation and manuring have given definite results and studies into the root development of the plant under various environmental conditions indicate the necessity of further investigation. The research work conducted so far touches only the fringe of the vast field of work required on this important crop and it is desired now to open a well equipped rice experimental station to start breeding work and further physiological experiments for which valuable material has been collected.

The work already done on the rice crop in the United Provinces has been described in detail in the following publications by Mr. R. L. Sethi :—

A preliminary note on the rice crop in the United Provinces—*Pusa Bulletin*, 186—1928.

Root development of rice under different conditions of growth—*Memoirs of Department of Agriculture in India*, Volume XVIII, No. II—1929.

Classification and study of characters of the cultivated rice in the United Provinces—*Memoirs of the Department of Agriculture in India*, Volume XVIII, No. VI—1930.

An important problem in these provinces is the protection of the rice crop from attacks of *LEPTOCORISA VARICORNIS* F locally known as *Gundhi*. It attacks the early ripening kinds from the middle of August to the middle of October and in epidemic form it partially destroys the crop over enormous areas.

There is only one local variety *Sathi* a rough poor yielding early variety which on account of its morphological characters escapes attack. One of the earliest problems to be taken up under the new scheme will be breeding work with the object of transmitting the resistant character of *Sathi* to some of the finer kinds of early rice.

A few crosses were made in 1929 but further extension of this work will be more effectively done in a rice tract growing representative early types of rice.

Investigations of the threshing and milling qualities of the different strain of rice and a study of their characters on which their special value as food depends will also be undertaken. As already stated there is a large trade in rice between the United Provinces and the neighbouring provinces. *Hansraj* and *Bansmati* which are produced mainly in the United Provinces are in demand all over Northern India. The production of better types of these varieties would, therefore, be of more than provincial importance.

The cost of the proposed rice experiment station is given in the enclosure to this note. The total expenditure for a 5 years' scheme is :—

	Rs.
Staff	69,420
Travelling allowance	15,000
Supplies and Services	80,000
Equipment	51,950
Land and Buildings	94,000
Total	3,10,370

APPENDIX V-A.

REPORT OF THE COMMITTEE APPOINTED TO CONSIDER THE UNITED PROVINCES RICE RESEARCH SCHEME.

Programme of work.—It was explained that a good deal of work in plant genetics would continue to be carried on at Cawnpore but on the proposed new station some breeding work, notably in connection with the production of a hybrid resistant to the rice sapper insect, would be carried out. Testing of pure strains, their multiplication under botanical control, experimental work on rotations and cultivation methods suitable to the Sarda canal area would complete the programme of work. Mr. Sethi suggested that some chemical work also should be conducted on this station on the nutritive quality of United Provinces rice, and also some soil work. The Committee considered that such work would be better carried out at Cawnpore where fully equipped laboratories are available.

2. It was explained that approximately 32 acres of land would be under rice each year and 8 acres under sugarcane, the remainder of the 60 acres would be under other rotation crops.

3. *Recurring expenditure.*—The Committee approved of the pay proposed for the Assistant Paddy Specialist and of the proposals for the establishment subject to the substitution of 4 non-graduate fieldmen (plant collectors) on the scale 35—3—50 for two fieldmen on the higher scale originally proposed.

Allowances.—Travelling allowances should be reduced to Rs. 2,000 per annum.

Supplies and Services.—In view of what has been said above about the programme of work, the Committee consider that Rs. 1,500 per annum is sufficient for running charges of the laboratory and Rs. 6,000 per annum for running charges of the experimental station including field experimental work making a total of Rs. 7,500 per annum for Supplies and Services. As amended the recurring cost of the scheme would average Rs. 19,952 per annum, details being as follows :—

	1st year.	2nd year.	3rd year.	4th year.	5th year.	Total five years.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1. Pay of Officers—						
1. Assistant Paddy Specialist on Rs 250—25—750	3,000	3,300	3,600	3,900	4,200	18,000
Total pay of officers ..	3,000	3,300	3,600	3,900	4,200	18,000
2. Pay of establishment—						
1. Farm Superintendent on Rs 150—10—250	1,800	1,920	2,040	2,160	2,280	10,200
2. Research Assistants on Rs 150—10—250 each ..	3,800	3,840	4,080	4,220	4,560	20,400
4. Fieldmen on Rs. 35—3—50 ..	1,680	1,824	1,968	2,112	2,256	9,840
2. Laboratory Assistants on Rs 30—3—60 each	720	702	864	936	1,008	4,320
2. Laboratory attendants on Rs 12—2—22 each ..	288	336	384	432	480	1,920
1 Clerk and Store-keeper on Rs. 75—3—120 ..	900	936	972	1,008	1,044	4,860
1 Peon on Rs. 12 ..	144	144	144	144	144	720
Total pay of establishment ..	9,132	9,702	10,462	11,112	11,772	52,260
3. Allowances—						
Travelling allowance	2,000	2,000	2,000	2,000	2,000	10,000
Total allowances ..	2,000	2,000	2,000	2,000	2,000	10,000
4. Supplies & Services—						
Running charges of laboratory ..	1,500	1,500	1,500	1,500	1,500	7,500
Running charges of experimental station ..	6,000	6,000	6,000	6,000	6,000	30,000
Total supplies and services	7,500	7,500	7,500	7,500	7,500	37,500
Total recurring	18,632	19,292	19,952	20,612	21,272	99,760

Non-recurring—

Land—The Committee do not consider that the Council can acquire land for the Local Government. The land should be rented, or if acquired by Government, a rental may be charged to the scheme.

Buildings.—A field laboratory is necessary but in view of the programme referred to above, it can be less expensive.

Laboratory including carpentry work—The Committee consider that Rs. 10,000 is sufficient.

Cattle Shed.—The Committee consider Rs. 3,000 to be sufficient.

Inspection House.—The Committee do not consider that this should be included in the scheme.

Superintendent's quarters, Assistants' quarters and Farm servants' quarters.—When a reply is received from the Empire Marketing Board, the position in regard to residential accommodation on all rice research schemes will have to be re-examined. The United Provinces scheme should be treated in the same way as the others.

Lay-out of farm—The figure of Rs. 5,000 proposed is accepted, subject to detailed estimates after the land has been obtained.

Implements and farm equipment.—A sum of Rs. 2,000 should suffice, subject to the preparation of details in due course.

Bullocks—The Committee are inclined to consider that 8 pairs of bullocks may be necessary but that the average cost of Rs. 400 per pair is too high. The provision of Rs. 2,400 may be retained.

Tube-well—The Committee do not consider that a large tube-well costing Rs. 12,000 is justified as the farm is to be situated in the Sarda Canal area. A well and pumping-plant sufficient to protect the actual plant-breeding area, so that no strains may be lost due to any unforeseen interruption in the canal supply, is, however, necessary. For this Rs. 2,500 may be provided.

Fencing—This item is accepted.

Laboratory equipment.—The Committee consider that Rs. 5,000 is sufficient.

Gas Plant.—For this type of field laboratory, where no chemical work is undertaken, the Committee consider that a petrol gas plant of a Willett type, for example, would be adequate, Rs. 2,000 may be provided.

Members.

T. VIJAYARAGHAVACHARYA, (*Chairman*).

B. C. BURT.

P. H. CARPENTER.

R. S. FINLOW.

N. N. GANGULI.

G. R. HILSON.

B. A. KEEN.

T. F. MAIN.

F. J. PLYMEN.

R. L. SETHI.

M. S. A. HYDARI,

Secretary.

The 15th January 1931.

APPENDIX VI.

Proposals for research work on the physiology of the Rice Plant by Professor R. H. Dastur, Professor of Botany, Royal Institute of Science, Bombay.

Attention is invited to the attached letter from the Government of Bombay No. 3461-A/28, dated the 2nd December 1930 (and enclosure). The scheme, which is explained fully in Professor Dastur's note, dated the 15th September 1930, involves a total expenditure of Rs. 10,300 spread over a period of three years. The scheme is for the consideration of the Advisory Board.

M. S. A. HYDARI,

Secretary.

Dated 9th December 1930.

ENCLOSURE I.

COPY OF LETTER FROM UNDER SECRETARY TO THE GOVERNMENT OF BOMBAY, REVENUE DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NO. 3461-A.128, DATED THE 2ND DECEMBER 1930.

Rice Physiology Scheme.—Application for a grant-in-aid for the—.

With reference to your letter No. 1817-Genl., dated 17th September 1930, I am directed by the Government of Bombay (Transferred Departments) to forward 100 copies of the Rice Physiology Scheme prepared by Professor R. H. Dastur, Professor of Botany, Royal Institute of Science, Bombay, and to state that the scheme was laid before the Provincial Agricultural Research Committee at its meeting held on 13th October 1930. The Committee has asked this Government to commend the scheme to the favourable consideration of the Imperial Council of Agricultural Research. The Government of Bombay support it and recommend that a grant-in-aid of Rs. 10,300 may be made towards the cost of the scheme. I am to add that the provincial contribution to the scheme will be relatively considerable as the Royal Institute of Science, in addition to providing the services of Professor Dastur, will provide facilities in the shape of the use of their buildings, laboratories and some apparatus. The Government of Bombay will not therefore be in a position to make any further monetary contribution towards the cost of the scheme.

ENCLOSURE II.

RICE PHYSIOLOGY SCHEME PREPARED BY PROFESSOR R. H. DASTUR,
PROFESSOR OF BOTANY, ROYAL INSTITUTE OF SCIENCE,
BOMBAY.

The Physiology of the Rice plant has been studied so far mainly with a direct view to cultivation and the work done has centred mainly on the manurial requirements of the plant; valuable information has been collected on this particular topic. What is still needed is special knowledge of the life processes of the plant, and how these processes are affected by external factors, namely soil and climate. A thorough study of the Physiology of the Rice plant would yield results of practical value which will enable us to tell the requirements of the plant better than at present.

I commenced work on the subject (the Physiology of the Rice plant) in 1927, in conjunction with post-graduate students. The following summary indicates what has been done and what is going on:—

- (1) The absorption of water from the soil depends upon the suction pressures of the plant: in order to determine the force with which water is absorbed, the osmotic and suction pressures of the Rice plant were measured throughout its life-time; this was done successively for three seasons. Reliable information has been collected on the subject and is in course of publication.
- (2) During the progress of the above investigation it was discovered that the addition of ammonium sulphate to the soil brought about a sudden rise in the osmotic and suction pressure of the plant. This fact led to a fresh avenue of research. Increase in the osmotic and suction pressure showed that the salt was absorbed. When plants were treated with nitrates no such rise was noticed: it is already known that nitrates are not absorbed by the plants in the early stages of growth. Hence I attempted to determine if the absorption of a salt and its relative value as a fertilizer can be found by measurements of the pressures of the plant before and after treatment. These measurements are easily carried out. The results so far obtained are very encouraging: if and when they are finally established there will be in the hands of agriculturists a simple method for determining the entry of a salt and its relative value as a fertilizer to the plant. At present the only method that is available requires the lengthy method of chemical analysis of the plant and measurement of the yield of straw and grain.
- (3) It is known that nitrogen is absorbed by the Rice plant in the form of ammonium salts in the early stages and of nitrates in the latter stages. But no quantitative data has been collected about the intake of salts from the external medium, and nothing is known about their absorption ratios (i.e., the relation between the final internal and external concentration of the salt). This is important because the entry of the salt ceases when the position of equilibrium between inside and outside is reached. This is probably the cause of waste of nitrogenous fertilizers supplied to the soil. The investigation carried on here has yielded the following facts:—
 1. There is unequal absorption of NH_4^+ and SO_4^{2-} ions, the former being absorbed in excess of the latter.
 2. Absorption of NH_4^+ ions decreases as the plant ages.
 3. Absorption of NO_3^- ions increases as the plant ages.

4. The absorption of NH_4 , SO_4 or NO_3 ions is independent of the presence or absence of foreign ions in the external medium.
5. The absorption ratios for NH_4 and SO_4 for different concentrations of $(\text{NH}_4)_2\text{SO}_4$ at a particular stage of growth are expressed by the equation $y = a + b$ where a and b are constants, i.e., the curves for the ratios are straight lines. Similar information is being collected for other salts.
- (4) The photosynthetic activities of the Rice plant are measured (a) by estimating the carbohydrates in the leaves at definite intervals in the season and (b) by measuring the absorption of carbon dioxide, per unit leaf area. Apart from other points of importance I am attempting to prepare correlation tables between the photosynthesis and the water content of the leaves; I have established these relationships between the two in my work on other plants. If this is done, it would be possible to tell approximately the photosynthetic activity of a leaf by finding its water content.
- (5) Similarly the respiration and transpiration activities of the Rice plant are being investigated.

My work on the Physiology of Rice is carried on with the help of post-graduate students. At present I have 7 post-graduate students working on the subject. I find that the work suffers because these students tend to leave at the end of two years while fresh students take time to learn the technique of the work. I therefore need the help of an assistant who would be a student who has already worked under me on the physiology of the Rice plant for at least two years.

The general expenses are met by my department and I need some special apparatus for the work: so I propose the following expenditure for a period of three years:—

Research Assistant.	1st year.	2nd year.	3rd year.	Total.
	Rs.	Rs.	Rs.	Rs.
(Rs. 150—25—200)	1,800	2,100	2,400	6,300
Apparatus and Chemicals	2,500	1,000	500	4,000
Total	4,300	3,100	2,900	10,300

It will be seen from the above statement of expenditure that the grant I ask for is small in comparison with the amount of work that will be done.

(Signed) R. H. DASTUR.

Department of Botany,
Royal Institute of Science.
Bombay, 16th September 1930.

APPENDIX VII.

LETTER FROM THE SECRETARY TO THE GOVERNMENT OF INDIA, DEPARTMENT OF EDUCATION, HEALTH AND LANDS, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 1463-AGRI, DATED THE 10TH JULY 1930.

Education and research in Dairying.

I am directed to invite a reference to the recommendations made by the Royal Commission on Agriculture in India in paragraph 211 of their report in regard to the Imperial Institute of Animal Husbandry and Dairying at Bangalore and its substations at Willington, Karnal and Anand. The Royal Commission considered that the Dairying section of the Institute should merely be looked upon as a necessary provision during a transition stage in the work of cattle improvement and should be continued only until the establishment of a thoroughly efficient dairy school as an integral part of one or more agricultural colleges. They did not, however, recommend any change in the existing organisation during the tenure of office of the present Imperial Dairy Expert, but were of opinion that before he retired from service, arrangements should be made to transfer the work of higher instruction in dairying to the agricultural colleges and the research work on the manufacture of important milk products to Pusa or some other suitable centre.

2. This subject was discussed at the Conference conveyed by the Government of India at Simla in October 1928 to consider the report of the Royal Commission. The view taken by almost all the provincial representatives at the Conference was that there was a demand for higher training in dairying which the agricultural colleges were not then in a position to meet and that in these circumstances it would be premature to close down the Dairying Section of the Institute. In deference to this opinion, the Government of India decided not to embark on any immediate change in the organisation of that section. They, however, asked the local Governments to examine, in the meantime, the recommendation that a thoroughly efficient dairy school should be established as an integral part of one or more agricultural colleges and that the curriculum of all agricultural colleges should include instruction in cattle breeding, feeding of dairy cows and handling of milk, and enquired from them what action they proposed to take in regard to them. The replies of the local Governments are now complete and I am directed to forward copies of them with the request that they may be placed before the Imperial Council of Agricultural Research and that the views of the Council in regard to the facilities which should be provided by the Government of India for education and research in dairying may be furnished to Government in due course.

Schedule of papers sent:

1. Letter to all local Governments, No. 682-Agri., dated the 2nd May 1929.
 2. Letter from the Government of Bengal, No. 373-T. A. I., dated the 18th June 1929.
 3. Letter from the Government of Assam, No. 1493-E., dated the 24th June 1929.
 4. Letter from the Government of Madras, No. 1096-Misc., dated the 29th June 1929.
 5. Letter from the Government of the Central Provinces, No. 475/338-XIV., dated the 6th July 1929.
 6. Letter from the Government of Bombay, No. 2670-A./28, dated the 15th July 1929.
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7 Letter from the Government of the United Provinces, No. 618-A., dated the 23rd July 1929.

8. Letter from the Government of Burma, No. 193-O., dated the 4th October 1929.

9. Letter from the Government of Bihar and Orissa, No. 207-D. R., dated the 20th June 1929.

10. Letter from the Government of the Punjab, No. 5729-D., dated the 17th December 1929.

LETTER TO ALL PROVINCIAL GOVERNMENTS, No. 682-AGRI., DATED THE 2ND MAY 1929.

I am directed to invite attention to the recommendations made by the Royal Commission on Agriculture in India in paragraph 211 of their Report in regard to the Imperial Institute of Animal Husbandry and Dairying at Bangalore and its sub-stations at Wellington, Karnal and Anand. The Royal Commission considered that the Dairying Section of the Institute should merely be looked upon as a necessary provision during a transition stage in the work of cattle improvement and should be continued only until the establishment of a thoroughly efficient dairy school as an integral part of one or more agricultural colleges. They did not, however, recommend any change in the existing organisation during the tenure of office of the present Imperial Dairy Expert, but were of opinion that, before he retires from service, as in the normal course he will do in 1931, arrangements should be made to transfer the work of higher instruction in dairying to the agricultural colleges and the research work on the manufacture of important milk products to Fusa or some other centre at which chemical assistance is readily available.

2. This subject was discussed at the Conference convened by the Government of India at Simla in October last to consider the Report of the Royal Commission. The view taken by almost all the Provincial representatives at the Conference was that there is a demand for higher training in dairying which the agricultural colleges are not at present in a position to meet and that, in these circumstances, it would be premature to close down the Dairying Section of the Institute. In deference to this opinion, the Government of India do not propose to make any immediate change in the organisation of that Section. The question of its future will, however, be examined in connection with the proposals for an enlarged Institute of Animal Nutrition which are at present under their consideration. The advice of the Council of Agricultural Research, when constituted, will also be obtained. In the meantime, I am to ask that the Government of Madras/Bombay, etc., will be good enough to examine the recommendations of the Royal Commission that a thoroughly efficient dairy school should be established as an integral part of one or more agricultural colleges and that the curriculum of all agricultural colleges should include instruction in cattle breeding, the feeding of dairy cows and the handling of milk, and to report what action they propose to take in regard to them.

LETTER FROM THE GOVERNMENT OF BENGAL, No. 373-T.A.I., DATED THE 18TH JUNE 1929.

I am directed to refer to your letter No. 682-Agri., dated the 2nd May 1929, in which you ask for a report as to the action proposed to be taken by this Government in regard to the recommendations of the Royal Commission on Agriculture in paragraph 211 of their report that a thoroughly efficient

dairy school should be established as an integral part of one or more Agricultural Colleges and that the curriculum of all Agricultural Colleges should include instruction in cattle breeding, the feeding of dairy cows and the handling of milk.

2. In reply, I am to say that in Bengal there is a scheme for the establishment of an Agricultural Institute at Dacea in which dairying will form an integral part of the curriculum. The Institute scheme is now undergoing examination in the light of the recommendations of the Commission but there is no likelihood of its being taken up at present for want of funds. A separate dairy scheme providing instruction in dairying at the Dacea farm has been administratively approved and is awaiting provision of necessary funds. This scheme will include modern machinery and apparatus of various kinds and provides for instructional courses. It is also in contemplation that when the Institute scheme materialises this dairy will form part of the Institute.

LETTER FROM THE GOVERNMENT OF ASSAM, No. 1493-E., DATED THE 24TH JUNE 1929.

Recommendation of the Royal Commission on Agriculture regarding the establishment of a dairy school as an integral part of one or more agricultural Colleges.

I am directed to acknowledge the receipt of Mr. Reid's letter No. 682-Agri., dated the 2nd May 1929, on the above subject, and to say that the Government of Assam have considered carefully the recommendation of the Royal Commission regarding the establishment of a dairy school. There is no agricultural college in Assam and it is not likely that one will be created for many years to come. This Government have, however, secured the services of a Dairy and Cattle Expert and are conducting experiments in cattle breeding and hope in due course to open more cattle farms and dairies (possibly on co-operative lines) in the province. At present, therefore, the Assam Government are disposed to start a class for training students in animal husbandry and dairying, when one of the Government farms either at Shillong, Khanapara, Jorhat or Sylhet is sufficiently advanced and stocked to admit of practical tuition being given. It is unlikely that a class can be started before 1931.

Meanwhile the Government have arranged to send two students to be trained at the Imperial Institute of Animal Husbandry and Dairying at Bangalore and are giving them scholarships.

LETTER FROM THE GOVERNMENT OF MADRAS, No. 1096-Misc., DATED THE 29TH JUNE 1929.

Recommendation of the Royal Commission on Agriculture.

I am directed to reply to Mr. Reid's letter No. 682-Agri., dated 2nd May 1929, wherein the Government of India enquire what action this Government propose to take on certain recommendations of the Royal Commission contained in paragraph 211 of their report. In that paragraph the Commission recommend, among other things, that a thoroughly efficient dairy school should be established as an integral part of one or more agricultural colleges and that the curriculum of all agricultural colleges should include instruction in cattle breeding, the feeding of dairy cows and the handling of milk. In regard to the latter, I am to state that at the Agricultural College, Coimbatore, the curriculum for the degree course—the only course taught there—includes instruction in cattle breeding, the feeding of dairy cows and the handling of milk and butter making.

2 As regards the establishment of an efficient dairy school, I am to state that there would be no insuperable difficulty in establishing one at Coimbatore, provided it is found necessary. I am, however, to point out that the Royal Commission recommend that a school should be established as an integral part of one or more agricultural colleges. Such a school already exists at Allahabad and it will have to be decided whether schools should be established at any other places. This matter appears to this Government to be one for the Council of Agricultural Research to decide, and if the Council decides that one should be opened at Coimbatore the matter will surely be considered by this Government.

COPY OF A LETTER FROM THE GOVERNMENT OF THE CENTRAL PROVINCES, No. 475/338-XIV, DATED THE 6TH JULY 1929.

I am directed by the Governor in Council to refer to Mr. Reid's letter No. 682-Agri., dated the 2nd May 1929, asking this Government to report what action it proposes to take in regard to the recommendations of the Royal Commission on Agriculture that a thoroughly efficient dairy school should be established as an integral part of one or more agricultural colleges and that the curriculum of all agricultural colleges should include instruction in cattle breeding, the feeding of dairy cows and the handling of milk.

2. In reply I am to say that instruction in cattle breeding and feeding and in the handling of milk dairying is already included in the regular course at the Agricultural College, Nagpur. This Government, as at present advised, does not think it necessary at present to provide for more specialised instruction in dairying technique as there is little demand for such training by students desiring to become instructors in dairying or to take up this industry on modern lines. The position will, however, be re-examined in future should a local demand from prospective dairy managers arise, but, for the present the needs of the province in this respect are amply met by a central institution.

COPY OF A LETTER FROM THE GOVERNMENT OF BOMBAY, No. 2670-A/28, DATED THE 15TH JULY 1929

With reference to Mr. Reid's letter No. 682-Agri., dated 2nd May 1929, I am directed by the Government of Bombay (Transferred Departments), to state that they have examined the recommendation of the Royal Commission on Agriculture that a thoroughly efficient dairy school should be started as an integral part of one or more agricultural colleges, and that they have come to the conclusion that it is not necessary to provide for the advanced teaching of dairying at the Agricultural College, Poona, as very few students are desirous of qualifying themselves for the Indian Dairy Diploma and as qualifications in dairying do not offer many opportunities for employment. I am to point out that the facilities for such training at Bangalore are abundant, and that advantage has been taken of them in the past by a few men from this Presidency. It is the view of the Agricultural Department of this Presidency that the dairy teaching at the Poona College should be confined to the knowledge essential for the ordinary B. Ag. degree course and that there should be a special course suitable for practical men who wish to practise improved dairying methods but who do not wish to take the Indian Dairy Diploma. Proposals are at present under the consideration of the Department for improving the work at the College on these lines. With regard to the second recommendation of the Royal Commission, that the curriculum of all agricultural colleges should include instruction in cattle breeding, feeding of dairy cows and handling of milk, I am to observe that

there is adequate provision for this in the course of the Poona Agricultural College and that advanced animal husbandry and dairying is taught as a special subject in certain classes.

COPY OF A LETTER FROM THE GOVERNMENT OF THE UNITED PROVINCES, No. 613-A., DATED THE 23RD JULY 1929.

In reply to Mr. Reid's letter No. 682-Agri., dated 2nd May 1929, I am directed to say that the Government of the United Provinces have had the question of the provision of advanced instruction in animal husbandry and dairying under consideration for some time. There is at present a dairy attached to the Agricultural College at Cawnpore, and elementary instruction in these subjects is included in the four years diploma course of that college; and also in the two years vernacular course of that college, and in the course of instruction given at the Bulandshahr Agricultural School. The Government of India, however, have declined to recognise any of these courses as sufficient for the Indian Diploma in Dairying on the ground that the equipment and staff are at present insufficient.

2. The Allahabad Agricultural Institute, which is a private institution, gives a complete and advanced course in animal husbandry and dairying of the same standard as that given at the Imperial Institute, Bangalore; and the Allahabad Institute is recognised by the Government of India for the Indian Diploma. The institute has applied to the Government of the United Provinces for financial assistance, and the Government consider that it would be cheaper and more satisfactory for them to develop this institute as an institution for advanced instruction for specialists in dairying, and to place it in a position to give efficient training up to the B. Sc. standard rather than to increase the equipment and staff at the Agricultural College, Cawnpore, where the accommodation is already fully occupied by the existing courses. The Allahabad Institute, however, is not at present affiliated to a university, and is experiencing difficulty in securing students of the right type, because they cannot obtain a university qualification at the conclusion of their course, and are therefore handicapped in obtaining employment. The Government's final decision on the question of giving assistance for the development of this institute will depend on it being able to obtain certain facilities from the Allahabad University for the grant of degree in agriculture with special emphasis on animal husbandry.

COPY OF A LETTER FROM THE GOVERNMENT OF BURMA, No. 193-O., DATED THE 4TH OCTOBER 1929.

Recommendations made by the Royal Commission on Agriculture in paragraph 211 of their Report regarding animal husbandry.

I am directed to reply to your letter No. 682-Agri., dated the 2nd May 1929, on the subject of the above recommendations of the Royal Commission on Agriculture.

2. In reply I am to say that the position of Burma in regard to dairying differs from that of other provinces in India. The rural population of Burma are not generally consumers of milk, butter and other dairy products and there is no demand from the agricultural population for instruction in dairying. Such demand for this instruction as does exist in Burma comes from people engaged in the dairying business in the big towns. In these circumstances, the Government of Burma do not propose themselves to establish a dairy school as an integral part of any Agricultural College in Burma. It would, however, be

advantageous to Burma if an efficient school existed in connection with some Agricultural College in India, since as has already been pointed out, there is some demand for instruction in dairying from those engaged in the dairy business in big towns.

3. As regards the second recommendation that the curriculum of all Agricultural Colleges should include instruction in cattle breeding, the feeding of dairy cows and the handling of milk, I am to say that some instruction in these subjects is already provided for in the curriculum of the Mandalay Agricultural College, while a small dairy herd of Scindhu-bred cattle maintained at the College farm provides opportunities for practical dairying work. For the reasons explained in the preceding paragraph of this letter, the Government of Burma think that the provision already made at the Mandalay Agricultural College for instruction in these subjects is sufficient and they do not think it necessary to alter the curriculum of the College so that increased attention may be given to these subjects.

4. The conclusion is that as far as Burma is concerned no special action is necessary on the two recommendations of the Royal Commission on Agriculture referred to in the letter under reply.

COPY OF A LETTER FROM THE GOVERNMENT OF BIHAR AND ORISSA, No. 207-D. R.,
DATED THE 20TH JUNE 1929.

I am directed to refer to Mr. Reid's letter No. 682-Agri., dated the 2nd May 1929, in which the Government of India ask the local Government to examine the recommendations of the Royal Commission on Agriculture that a thoroughly efficient dairy school should be established as an integral part of one or more agricultural colleges and that the curriculum of all agricultural colleges should include instruction in cattle breeding, the feeding of dairy cows and the handling of milk; and to report what action they propose to take in regard to them.

2. In reply, I am to say that the question of the establishment of an agricultural college in Bihar and Orissa, as recommended by the Royal Commission on Agriculture in paragraph 482 of their report, is now under the consideration of the local Government. It is not possible to say definitely at this stage what the curriculum of the college will actually be, but it is contemplated that instruction in cattle breeding and management, the feeding of dairy cows and the handling of milk will form a part of it.

3. A cattle breeding and dairy farm has already been established at Patna along side the veterinary college, which it is proposed to start next year. The curriculum of the Veterinary College has not yet been definitely decided but it is proposed to provide special facilities for higher training in animal husbandry and it is also proposed to place the cattle breeding and dairy farm directly in charge of the Principal. If the Agricultural College is also established at Patna, it will be possible to train all the agricultural and veterinary students in cattle breeding, dairying and the care of cattle at the farm and eventually to prepare students for the Indian Dairy Diploma. In that case, it will be unnecessary to establish a dairy school as an integral part of the new Agricultural College.

4. The local Government are advised that one or two fully equipped dairy schools in India are likely to prove sufficient for the present to meet the requirements of the small number of students who would be forthcoming. They are also advised that there will be a demand for higher instruction in dairying at Bangalore for some years to come. If the two-year course certificate of an Agricultural College, or its equivalent, were made the minimum qualification for

admission to the Bangalore Indian Dairy Diploma Course, that Institute would perform a valuable function. Future dairy instructors should take the degree course of an Agricultural College and a post-graduate course at Bangalore which may well become the centre for post-graduate training.

COPY OF A LETTER FROM THE GOVERNMENT OF THE PUNJAB, No. 5729-D., DATED THE 17TH DECEMBER 1929.

I am directed to refer you to your letter No. 682-Agri., dated the 2nd of May 1929, on the subject of instruction in Animal Husbandry and Dairying, and the recommendations of the Royal Commission in paragraph 211 of their report. The Punjab Agricultural College, Lyallpur, already makes full provision in its curriculum for instruction in cattle-breeding and feeding, handling of milk, dairying, etc., and no further action appears to be called for in this direction in the Punjab.

2. The course at present given in Lyallpur does not qualify for the Indian Diploma in Dairying, but if there ever were a demand sufficient to justify such action, it would not be difficult to raise the standard of instruction to what is required for the Indian Diploma. Until, however, further evidence is forthcoming that such a course, if established, would be appreciated and utilised, the Punjab Government regards such a proposal as less urgent than several others on its programme.

3. There is reason to believe that a short vernacular course lasting about 6 months in practical dairying would prove more popular than a two-years diploma course. Youths, who have been educated up to the Middle Standard, could there be given a useful and practical course in cattle management, feeding and dairying, and would prove of value to large cattle owners and dairy men. Requests for men trained on these lines have on several occasions been received, and the proposal to establish such a course is under consideration.

APPENDIX VIII.

Statement showing the recommendations contained in the Proceedings of the third meeting of the Sugar Committee.

Serial No	Item of the Agenda.	Subject	Recommendation of the Committee.	Action taken.
1	Item No 1 of the Agenda.	Decisions of the Governing Body on the recommendations of the Sugar Committee (2nd meeting)	Noted	No action required..
2	Item No 2 (a) of the Agenda	Award of a prize of Rs 1 lakh for the design of a satisfactory small power cane-crusher.	The Committee noted that the Governing Body had decided to drop the proposal but had approved instead a scheme for a grant of annual prizes and medals of a non-competitive nature for agricultural improvements in India.	Ditto.
3	Item No 2 (b) of the Agenda.	Application from the Government of Bengal for a grant for experimental work on cane crushing and gur boiling plants	Recommended	Has been dealt with in circulation..
4	Item No 3 of the Agenda	Application from the Government of Bombay for a grant for work at Manjri (Poona).	That arrangements be made which can be expanded and fitted into a general scheme of agricultural research as proposed by the Director of Agriculture, Bombay, for an immediate and co-ordinated attack under unified control of the main problems connected with sugarcane in the Deccan, namely, soil management, the production of better varieties and physiology of the sugarcane plant and to await detailed proposals from the Bombay Government	Placed before the Advisory Board—vide Subject No. 9 of the Agenda, January 1931 meeting.
5	Item No 4 (a) and (b) of the Agenda.	Chain of sugarcane research stations; proposed stations in the United Provinces and the Punjab.	Noted that no scheme had so far come from the United Provinces but that one from Punjab was likely to be submitted in the near future.	No action required.
6	Item No 4 (c) of the Agenda	Assam—application for a grant.	Not recommended	The Assam Government will be informed accordingly.
7	Item No. 4 (d) of the Agenda.	Bengal—application for a grant.	Recommended	Placed before the Advisory Board—vide Subject No. 7 of the Agenda, January 1931 meeting.
8	Item No. 5 of the Agenda.	Sugarcane Insect Pests (including the carriers of mosaic) scheme for work at Fusa.	Further examination deferred till the return of Mr. Fletcher from leave.	No present action. Will be placed again before the Sugar Committee after Mr. Fletcher has returned from leave.

Statement showing the recommendations contained in the Proceedings of the third meeting of the Sugar Committee—concl'd.

Serial No.	Item of the Agenda.	Subject.	Recommendation of the Committee.	Action taken
9	Item No. 6 of the Agenda.	Enquiries into the cost of cane and gur production including enquiry into the marketing of gur.	That this enquiry should now be undertaken about February 1931 when the sugarcane season was on. Proposals made in regard to the staff, the area for enquiry and method of control, etc.	Placed before the Advisory Board—vide Subject No. 8 of the Agenda, January 1931 meeting.
10	Item No. 7 of the Agenda.	Resolutions of Chowdhry Mukhtar Singh.	As regards the geological and chemical survey of the sugarcane growing area, it was agreed that, if possible, information as to the cost of such surveys in Java and the United States of America and the length of time taken by them should be ascertained and the subject discussed at a future meeting of the Committee. In regard to finding of best means of providing water facilities for sugarcane cultivation, the discussion showed that irrigation practice varied from province to province and the question was really one which could only be adequately dealt with by the proposed Central Board of Irrigation.	Necessary action is being taken.
11	Item No. 8 of the Agenda.	Co-opting of a representative of the Bihar Planters' Cane Growers' Association.	Not recommended	The Bihar Planters' Cane Growers' Association will be informed accordingly.
12	Item No. 9 of the Agenda.	Reference to the Tariff Board of the question of the protection for sugar industry.	The Committee decided to leave further action in regard to the Tariff Board enquiry to the Chairman.	The Vice Chairman deputed the Agricultural Expert to give evidence before the Tariff Board on behalf of the Council.
13	Item No. 10 of the Agenda.	Mr. Sanyal's report on Hathi's opinion on sugar manufacturing process.	The Committee were of opinion that what was now required was a test of the Hathi process over a whole season under commercial conditions side by side with the Rolikhmi <i>Roll</i> . They recommended that the test on a commercial scale under the supervision of Lala Har Sahai Gupta should be financed by the Council subject to the Chairman's scrutiny of the proposed expenditure with a view to cutting down the total cost (Rs. 10,600).	The test is being conducted with the sanction of the Governing Body.

APPENDIX IX.

Letter from R. S. Finlow, Esq., C.I.E., B.Sc., F.I.C., Director of Agriculture, Bengal, to the Secretary to the Government of Bengal, Department of Agriculture and Industries, No. 7956-A, dated Ramna, Dacca, the 2nd May 1930.

I have the honour to say that, in addition to the items already submitted for discussion at the coming meeting of the Provincial Research Council, I beg to add another scheme for the provision of a sugarcane seedling testing station for Bengal. The work of the Agricultural Chemist is leading us to the conclusion that Bengal conditions of soil, climate, etc., are more suitable than most in India, for the successful cultivation of sugarcane and, on this account, it may prove to be the case that Bengal will be able to compete with Java in the production of sugar, without the virtual protection which freightage on the 300—600 miles land from Calcutta to Bihar and the United Provinces respectively gives to these Provinces.

One important point which the scheme involves is that canes which have proved suitable for the Punjab, the United Provinces, and even for Bihar, have not always done well in Bengal, or *vice versa*. The 2nd point is that all the above-mentioned provinces have schemes for establishing cane seedling testing stations which they are asking the Imperial Research Council to finance. Bengal with all its proved potentialities must not be left behind.

The area under cane in Bengal, which is about 200,000 acres, has increased in recent years owing to the introduction of high yielding canes—latterly Co.-213. Formerly Bengal imported about 200,000 maunds of *gur* per annum, but increased area and higher yield appear to have given the Presidency an exportable surplus.

The scheme, details of which will follow, is inexpensive. The total cost for several years will probably be within Rs. 10,000 and it may be taken for granted that the results will be out of all proportion.

Details of the scheme will be submitted immediately. The above is merely to justify inclusion of the item on the agenda for the coming meeting.

Letter from R. S. Finlow, Esq., C.I.E., B.Sc., F.I.C., Director of Agriculture, Bengal, to the Secretary to the Government of Bengal, Department of Agriculture and Industries, No. 8034-A, dated Ramna, Dacca, the 3rd May 1930.

In continuation of my letter No. 7956, dated the 2nd May 1930, I have the honour to enclose herewith a rough estimate of the expenditure involved in setting up the sugarcane seedling testing station at Dacca. The scheme and estimate should be included in the agenda for the forthcoming meeting of the Bengal Provincial Research Council.

ESTIMATE OF EXPENDITURE INVOLVED IN SETTING UP A SMALL SUGARCANE SEEDLING TESTING STATION AT AGRICULTURAL RESEARCH STATION, DACCA.

Land :—About 5 acres in the Dacca Farm for which no charge would be incurred.

Non-recurring expenditure.

Buildings—

	Rs.
One corrugated iron shed for tools, etc.	650
Fencing	700
Total non-recurring expenditure	1,350

Recurring expenditure.

			Rs	
1 Field Assistant at Rs., 160	..	..	1,920	p. a.
1 Mali at Rs. 35 per mensem	..	..	420	
			<hr/>	
Total recurring expenditure for one year	..		2,340	
			<hr/>	
Total recurring expenditure of five years	..		11,700	
Total, estimated cost for five years	..		13,050	

Extract from "proceedings of the third meeting of the Sugar Committee appointed by the Imperial Council of Agricultural Research, held at Poona in August 1930.

The Committee considered a Sugarcane Seedling Testing Station at Dacca to be necessary and recommended that the scheme (Appendix I) submitted by the Bengal Government costing Rs. 1,350 non-recurring and Rs 11,700 recurring spread over five years or a total of Rs. 13,050 be sanctioned. In this connection Mr. Sarangdhar Das enquired whether a Sugarcane Seedling Testing Station was not necessary for Orissa also. Mr. Burt replied that the proposed sugarcane station in Bihar would supply seedlings to the six experimental farms in Orissa. Rao Bahadur Venkataraman said that as far as he knew conditions in Orissa were entirely different from those in Bihar. It was agreed that enquiries should be made from the Government of Bihar and Orissa as to what they proposed to do in order to meet the needs of the sugarcane tract in Orissa.

Mr. Walchand Hirchand said that judging from what the Sugar Committee had seen on its visit on the 10th to the Belapur Sugar State he considered that a seedling testing for Bombay was also necessary. Mr. Main replied that the question of the establishment of a sub-station of Coimbatore in the Bombay Dacca was now under discussion between the Imperial Sugarcane Expert and himself.

APPENDIX X.

SCHEME FOR AN ECONOMIC ENQUIRY INTO THE COST OF SUGAR-CANE PRODUCTION IN THE UNITED PROVINCES, NORTH BIHAR, BOMBAY AND THE PUNJAB.

In paragraph 6 of their *interim* report, the Sugar Committee appointed by the Imperial Council of Agricultural Research considered the question of the cost of production of sugarcane in different parts of India. They came to the conclusion that the results of such an enquiry would be of value to the Council by enabling it to decide in what areas the sugarcane industry has the best prospects of development and in what places, and in what manner, funds for research and experimental work could best be allotted. They added that an enquiry of this nature must necessarily be conducted by a special staff which would include :—

- (1) An Economist to plan the enquiry, assist in the drafting of the questionnaire and work out the details ;
- (2) An Assistant Economist in each tract to control the work of the investigators ;
- (3) Three village investigators for each tract under study to make the Primary village enquiries.

After describing the general scheme of the enquiry, they recommended that no action should be taken in this matter till they had considered it further at their next meeting (January 1930).

2 The Committee were unable to dispose of this question at their second meeting held at New Delhi in January 1930 ; it was accordingly considered at the third meeting of the Committee held at Poona in August 1930. Attention is invited to paragraph 8 of their Proceedings of the 11th August 1930 (Enclosure I). There was a general consensus of opinion in the Committee that this enquiry should now be undertaken at the earliest possible moment. No change was recommended in the special staff except that the number of village investigators was raised from three to four for each province in order to provide for investigations in both irrigated and non-irrigated sugarcane areas for the four tracts, *viz.*, the United Provinces, North Bihar, Bombay and the Punjab. A rough estimate of the expenditure involved in the enquiry is also attached (Enclosure II). It is proposed that the enquiries should commence in December 1931.

3. The proposal is now submitted for the consideration of the Advisory Board.

M. S. A. HYDARI,

Secretary.

The 4th December 1930.

ENCLOSURE I.

Extract from the Proceedings of the Third Meeting of the Sugar Committee, appointed by the Imperial Council of Agricultural Research, held at Poona on the 11th and 13th August 1930.

8. *Enquiries into the cost of cane and gur production including enquiry into the marketing of gur.*—There was a general consensus of opinion in the Committee that this enquiry should now be undertaken at the earliest possible moment which would be about February 1931 when the sugarcane season was on. Proposals in regard to the conduct of the enquiry had already been formulated by the Committee at its first meeting in October 1929 and as it was felt that the appropriate time of enquiry was now approaching it was time to make concrete proposals in regard to the staff.

It was decided to leave the choice of the Economist who would plan the enquiry to the Chairman. A good Economist preferably with agricultural experience was what was required. The pay would have to depend upon the person selected but it was felt that it should not exceed Rs. 1,500 per mensem. The Economist should be engaged for one year with option on either side to extend his appointment to another year.

At its first meeting the Sugar Committee recommended that the four sugarcane areas selected for the enquiries should be Meerut, North Bihar, Bombay and the Jullundur District of the Punjab. It was now decided not to mention any particular place but to define the areas as the United Provinces, North Bihar, Bombay and the Punjab leaving the actual tracts to be decided upon later in consultation with the Director of Agriculture of the province concerned when the Economist joined.

As for the Assistant Economists of which there would be four it was felt that they should be Honours Graduates in Economics with some research experience the pay depending upon the person selected but not to exceed Rs. 350 per mensem.

In the original proposals three investigators were suggested for each tract. It was now pointed out that in order to provide for irrigated and non-irrigated sugarcane areas in each of the four provinces four investigators for each province instead of three would be required. These would be Agricultural College Graduates with experience of district work, especially sugarcane work. The pay of each would depend upon the man selected but it should not exceed Rs. 200.

In the matter of the control the Chairman suggested that the work should be conducted through the local Agricultural Departments. The Assistant Economists and the Investigators would be under the administrative control of the Director of Agriculture, the Economist in charge of the whole scheme who would be under the Council acting in consultation with the Directors of Agriculture concerned. This was agreed to as well as the suggestion that detailed arrangements might be left for adjustment after the Economist had joined. The Economist would be required a month or two before the local investigation started. Mr. Clark added a rider that the administrative control of the Directors of Agriculture over the subordinate staff as well as the fact that the Chief Economist would act in consultation with Directors of Agriculture should not in any way detract from the latter's responsibility for the whole enquiry. He should be finally responsible for its conduct. This was agreed to.

ENCLOSURE II.

Estimated cost of enquiry into the cost of production of sugarcane—1st year.

	Rs.	Rs.
*Economist @ 1,500 for 15 months	22,500	
Travelling allowance	2,500	
		25,000
4 Assistant Economists @ 350 for 15 months	21,000	
Travelling allowance	4,000	
		25,000
16 Investigators @ 200 for 12 months	38,400	
Travelling allowance @ 500 each	8,000	
		46,400
Contingencies		1,600
Printing of questionnaire books and forms		2,000
		1,00,000
The rates of pay shown are the maximum approved by the Committee and we hope for some saving especially on investigators whose average pay should not exceed above 150—a saving of 9,600		
		—9,600
Clerical staff for compilation (investigators will be required to assist) say 6 temporary clerks on about 60 per mensem for 6 months (2,160)		+2,160
Total (say)		92,560

* Assuming that the enquiry lasts 1 whole season, he will be need for 3 months extra at least.

APPENDIX XI

Sugarcane research scheme for the Bombay Deccan.

At their first meeting held at New Delhi in October 1929, the Sugar Committee appointed by the Imperial Council of Agricultural Research considered the question of a sugarcane research station in the Bombay Deccan. As, however, the detailed scheme relating to it had not been received from the Government of Bombay, the Committee decided to defer its examination until their second meeting held in January 1931. At that meeting no details of the proposed scheme for a sugar research station were received but a scheme of work in sugarcane Physiology was put forward. The Sugar Committee decided that their third meeting should be held at Poona in August 1930 in order that the special needs and problems of the Deccan Canal area might be discussed with the Director of Agriculture, Bombay, and other officers nominated by the Local Government. After consideration in August 1930, the following resolution was passed by the Committee :—

"That the Committee recommends that arrangements be made, which can be expanded and fitted into a general scheme of agricultural research as proposed by the Director of Agriculture, Bombay, for an immediate and co-ordinated attack under unified control of the main problems connected with sugarcane in the Deccan, namely, soil management, the production of better varieties and the physiology of the sugarcane plant and to await detailed proposals from the Bombay Government".

2. These detailed proposals are contained in the attached sugarcane research scheme for the Bombay Deccan received from the Government of Bombay. The total cost of the scheme over a five-year period is estimated at Rs. 5,22,088 made up of Rs. 67,918 non-recurring and Rs. 90,834 per annum or a total over five years of Rs. 4,51,170 recurring. The Bombay Agricultural Department will be able to contribute Rs. 1,30,850 towards the scheme if it is accepted in full as then the staff and budget of the present Manjri Experimental farm would be devoted to the scheme. In that case, the nett cost of the scheme will be Rs. 3,91,238 for 5 years.

3. It will be noticed that the scheme contains a provision of Rs. 23,000 a year under "contingencies" for cultivation and management of 100 acres of land. The scheme provides that 30 acres of cane should be cultivated annually; even at Rs. 20 per *palla* (the Director of Agriculture's lowest price) and 36 *pallas* per acre; this means receipts to the farm of Rs. 21,600 per annum without allowing for subsidiary crops, whilst expenditure has, as stated above, been budgeted in full at Rs. 23,000 a year. Actually, the farm should be practically self-supporting, i.e., contingencies would be covered by receipts. If that is so the nett cost of the scheme would be reduced by Rs. 1,15,000 to Rs. 2,76,238.

4. The scheme is now submitted for the consideration of the Advisory Board.

M. S. A. HYDARI,
Secretary.

SUGARCANE RESEARCH SCHEME FOR THE BOMBAY DECCAN (INCLUDING ROTATION CROPS).

INTRODUCTORY.

In August 1930 the Sugar Committee of the Imperial Council of Agricultural Research, at its session in Poona, passed the following resolution :—

"That the Committee recommends that arrangements be made, which can be expanded and fitted into a general scheme of agricultural research as proposed by the Director of Agriculture, Bombay, for an immediate and co-ordinated attack under unified control of the main problems connected with sugarcane in the Deccan, namely, soil management, the production of better varieties and the physiology of the sugarcane plant and to await detailed proposals from the Bombay Government."

The Sugar Committee further expressed the view that sugarcane research should be located at a place which is representative of the environmental conditions obtaining in the Deccan Canals Zone, and considered that a site more representative than Manjri Experimental Station, should be selected. This latter stipulation has materially affected the estimates, because a research scheme located at Manjri would naturally be very much cheaper than at some entirely new centre. If, however, this scheme is sanctioned in the form in which it is put up, it is proposed to make the staff and budget of the Manjri Experimental Station available as a Provincial contribution to the scheme. For this purpose it is proposed to close the Manjri Experimental Station, at least temporarily. This will not, of course, be possible if the scheme as a whole is not sanctioned as in that case Manjri would still be required.

THE PROBLEM.

The Deccan suffers from a very precarious rainfall, and history records a series of severe famines while scarcely years, in one or other part of this tract, are seldom, if ever, absent.

Owing to the geographical features of this part of India it so happens that a range of mountains fringes the Deccan on its Western frontier where the rainfall is not only excessive, ranging from upwards of 100 to over 200 inches, but is assured. It was therefore natural for Government to turn its attention to the problem of making, at least, some of this water available for irrigation in the arid Deccan.

The total areas* of land on the seven principal completed canals are :—

				Acre.
Commanded gross .. .. .	..	..	..	1,336,721
Commanded culturable .. .. .	..	..	..	1,076,938
Irrigable .. .. .	..	..	..	401,770
Annual Irrigation .. .. .	..	..	..	187,909

The completed works only represent about one-third of the programme, (i.e., completed plus projected schemes).

It is understood that His Highness the Nizam of Hyderabad has under consideration an important irrigation project, but his advisers have some misgivings on account of the difficult problems which have confronted the Bombay Government in developing irrigation in the Deccan.

The problem of developing Peninsular India (where natural facilities exist) through irrigation is, in fact, a very formidable one, apart from certain rice tracts. On the other hand the country stands in great need of irrigation owing to the precarious character of the rainfall as already remarked. In this connection attention may be directed to the description of the East Deccan in the report of the Bombay Provincial Banking Enquiry Committee, and it is

* Vide part II of the Irrigation Administration Report for 1927-28. The last figure is an average for five years taken from the Administration Reports for 1923-24 to 1927-28 (Statement III-B).

understood that a very similar state of affairs exists in tracts beyond the Bombay boundary.

Experience shows that it is not sufficient to build canals and place water within the reach of the cultivator. Unlike the cultivator of Indo-Gangetic India the cultivator of the Deccan finds it difficult to exploit canal irrigation facilities. His land is undulating and requires considerable outlay to make it fit for irrigation. The types of soil and subsoil and their depths vary very much, rendering irrigation, at least in the initial stages, a rather complicated affair.

It has, however, been ascertained that the Deccan is one of the finest sugar-cane tracts in the world provided proper judgment in choosing the soil and in managing the crop is shown. In particular the climate is very favourable to cane, and prolific crops of the superior thick soft canes can be produced. The great obstacle in the way of this crop has been the high cost of production, incurred by the average cultivator. This has placed the Deccan at a great disadvantage as compared with Northern India, as a cane-field. As an indication of the capacity of the Deccan to grow cane it may be pointed out that the average yield of gul on the Manjri Experimental Station over an area of not less than 10 acres over a period of 16 years has been 9,334 lbs. per acre, which is just over 4 tons per acre.

Apart from its own intrinsic merits cane has a special value in Irrigation—Agriculture in Peninsular India. It has provided the stimulus to agriculturists to make their lands fit for irrigation by levelling and generally laying them out. It has also been the cause of grading-up the condition of the soil through heavy applications of bulky manures. In fact it is generally admitted that a limited area of cane is, in practice, an indispensable factor in the development of canal agriculture.

Owing to several reasons, including the hitherto high cost of production, the total area of cane on the main canals in the Deccan has never exceeded 35,000 acres. But for reasons explained above the acreage is no criterion of the importance of the crop in the agriculture of the countryside. Moreover, in point of value, even this small area of crop means an annual crop-value of over two crores of rupees.

The cost of production by cultivators of cane is about 10½ annas per maund (Bengal) for plant cane as given in detail below in rupees per acre for a crop of 900 Bengal maunds of stripped cane :—

Serial No.	Operation.	Amount.
		Rs. A. p.
1	Ploughing, pulverising, ridging, discing and levelling ..	40 0 0
2	Bunding, making channel and dressing ends ..	12 8 0
3	Sets 12,000 or 8 per cent. on an acre of cane of 33 tons ..	46 12 0
4	Cutting, supplying, arranging and planting ..	10 0 0
5	Weeding ..	20 0 0
6	Earthing up ..	10 0 0
7	Farm yard manure 40 carts at Rs. 2-4-0 each ..	90 0 0
8	Cake groundnut=202 lbs. N. or 12 pallas at Rs. 81 per ton (May-June 1930) (supplying 7 per cent. N.) ..	104 0 0
9	Sulphate of Ammonia 224 lbs. at Rs. 170 per ton. N=45 to 47 lbs. ..	17 0 0
10	Powdering and applying ..	7 0 0
11	Water Rate ..	50 0 0
12	Labour for irrigation ..	20 0 0
13	Cutting, stripping, bundling and carting ..	35 0 0
14	Interest at Rs. 9 per cent. on Rs. 375 (half annual investment). ..	33.12 0 0
15	Supervision ..	30 0 0
16	Rent (Rs. 90 for 3 acres of which two-thirds is debited to cane) ..	60 0 0
	Total ..	586 0 0

* Calculated on the basis of contract and hired labour on a 10-anna wage.

Some years ago the cost of production was much higher. The question to-day, however, is how far can "costs" be further brought down.

The Bombay Department of Agriculture has done a considerable amount of work on this problem and has succeeded in bringing down the cost of production to approximately—

annas 8 per maund at Manjri for plant cane,

annas 7 per maund at Kopargaon for plant cane, and

annas 6 per maund at Kopargaon for ratoon cane.

These prices are based on a 10-anna wage standard at Manjri and 8 annas at Kopargaon, but peasant-cultivators would probably be satisfied with lower wages.

If we assume that the cost of cane is $10\frac{1}{2}$ annas per maund (Bengal) then the cost of gul will be Rs. 19-13-6 per palla (of 250 lbs.) or Rs. 175-12-0 per ton.

At Belapur where the cost of cane, including haulage is approximately 11 annas per Bengal maund the cost of sugar is approximately Rs. 9-8-0 per Bengal maund or Rs. 259 per ton.

The expansion of cane cultivation, which in turn governs the expansion of irrigation, in the Deccan which possesses such great natural advantages, obviously depends upon the profits to be made out of

(a) the gul industry or

(b) the sugar industry or both.

There is a general consensus of opinion that the market for Deccan gul is saturated for a price level of Rs. 20 to 25 per palla (of 250 lbs.) of gul. If this is accepted then there is no scope for expanding the cane area on a gul-basis unless the cost of producing gul can be brought down, substantially below Rs. 20 per palla.

As regards sugar the cost figure of Rs. 9-8-0 per Bengal maund, mentioned above, is still considerably higher than the North of India cost, and hence if Peninsular India is to become an important sugar-producing country it is necessary to bring down the cost of production still further.

For these reasons it is necessary to undertake much more fundamental research than has been possible in the past on the Manjri Experimental Station where the staff belongs to the Subordinate Service. Moreover, sugarcane research necessarily implies work on the rotation crops when economics is the central issue involved.

In the following section an attempt is made to indicate the field for fundamental research and incidentally to describe the research which has already been carried out on the Manjri Experimental Station.

It may be useful, however, to draw attention to the main factors through which it is hoped to effect a further reduction in "costs". These are (1) an improved variety of cane and (2) a further reduction in the quantity of manure used. There is also the wages-rate of 8 to 10 annas per man per day which may fall.

Hitherto a great variety of canes have been tested at Manjri, but none appear to be a better cultivator's cane than the local Pundia. However, certain

recently introduced canes at Belapur like E.K. 28 and P.O.J. 2878, which are also under trial at Manjri, are very promising. Our chief hope, however, appears to lie in the breeding of an improved cane specially for the Deccan.

The Imperial Sugarcane Expert at Coimbatore has for the last four years been giving his attention to the production of a "Noble" cane suitable for the Deccan; and he is now in a position to provide some material for trial. A further reference to this work will be found in the next section, but if the yield can be increased by 20 per cent. through an improved cane, without involving increased expenditure, the cost of a Bengal maund of plant-cane will fall from 8 annas to 6.4 annas on the Manjri figures and to 5.6 annas on the Kopergaon figures.

THE FIELD FOR FUNDAMENTAL AGRICULTURAL RESEARCH IN THE CANAL TRACTS OF THE BOMBAY DECCAN.

The following examples of the type of research required are given by way of illustration.

I.—The Soil.—The soil in the irrigated tracts is very variable in character as well as in depth, and experience shows that the soils behave very differently under irrigation. The whole subject of the reaction of different types of Deccan soils to irrigation requires to be investigated scientifically.

It is necessary to determine much more accurately, than has been possible in the past, just what degree of irrigation-intensity a particular soil or soil-condition can stand without sustaining injury.

Equally important is the investigation of counter treatment to prevent or at least control the injurious effects of irrigation on certain soil types. Farm practice, with this object in view, should be based on investigation by a Soil-physicist. At present the following precautions are taken by the Irrigation Department :—

- (1) Disallowing sugarcane on the less suitable lands.
- (2) Enforcement of hot-weather fallows in the sugarcane blocks.

The landowner, however, is justified in expecting something more than negative action on the part of Government. It is no doubt an effective means of preventing soil damage to prohibit a man from cultivating cane, but this imposes some responsibility on Government to advise him what crops can advantageously be grown on such prohibited lands and what treatment he can advantageously adopt to prevent his soil becoming damaged from a medium intensity of irrigation. The right treatment seems *inter alia*, to lie in the adjustment of the application of organic manures to the degree of damage sustainable from irrigation by a particular soil-type and in the right use of fallows and rotations.

Moreover from the standpoint of the landowner it is very important that no land should be put in the unprivileged class unless there is convincing scientific evidence justifying that classification because this determines the sale and rental value of the land and is thus a matter of vital importance to the owner.

The interests of the agriculturist therefore demand fundamental research in soil-physics.

II.—Improved Varieties of Cane.—A large amount of varietal work on cane has been done at Manjri and striking results have been obtained with certain

introduced varieties particularly as regards tonnage and sucrose content as may be gathered from the following statement :—

Serial Number. 1	Name of variety. 2	Growth period months. 3	Arrowing or not. 4	Tonnage.		Extraction.		Gul.	
				Cane per acre 5	Order of merit. 6	Percentage. 7	Order of merit. 8	In tons per acre. 9	Relative yields taking the yield of Pundia at 100. 10
1	Pundia ..	12-13	Non-arrowing	30-80	7	69-8	3	4-25	100
2	D 109 ..	12-12½	Arrowing ..	36-20	5	64-5	6	4-16	97-8
3	Striped D. 109.	12-13	Arrowing ..	36-65	4	70-1	2	4-49	105-6
4	H. M. 89	12-13	Arrowing ..	31-59	6	66-0	4	4-34	102-1
5	H. M. 310	12-13	Non-arrowing	38-31	2	65-2	5	4-22	99-3
6	H. M. 544	14-14½	Non arrowing	38-78	1	70-3	1	4-39	103-5
7	J. 213..	12-12½	Arrowing ..	36-91	3	67-3	7	4-11	96-7

Serial Number. 1	Name of variety. 2	Gul.		Sugar.			Juice.			
		Order of merit 11	Quality. 12	Sucrose per cent. on cane. 13	Available sugar in tons per acre. 14	Order of merit. 15	Brix corrected to 17-500. 16	Sucrose per cent. 17	Glucose percentage. 18	Purity. 19
1	Pundia ..	4	A	15-44	3-75	7	20-66°	18-35	1-37	83-62
2	D. 109 ..	6	A	13-86	3-76	6	19-1°	16-95	1-08	83-76
3	Striped D. 109.	1	A Superior.	11-68	4-43	1	19-49°	17-89	0-98	91-79
4	H. M. 89..	3	A do.	16-64	4-01	3	21-98°	20-04	0-62	91-16
5	H.M. 310..	6	A	14-19	3-88	6	18-41°	16-33	1-16	83-72
6	H M. 544..	2	A Superior.	13-67	4-32	2	18-34°	16-53	1-21	90-14
7	J. 213..	7	A	14-83	3-94	1	20-3°	19-77	0-48	91-43

Note.—The available sugar figures in column 14 are on the basis of actual extraction obtained and given in column 7 of the statement.

Unfortunately, however, all these varieties have one or more disabilities which prevent them replacing Pundia. For example Striped D 109 arrows and hence is unsuitable for adsali cultivation, while H. M. 544 is later in maturing than Pundia by about two months.

In these 'circumstances' it seems 'essential' to undertake sugarcane breeding with the special object of evolving a high class cane suitable for the Deccan, which is more economic than Punjab. The Imperial Sugarcane Expert at Coimbatore has already started breeding operations on "noble" canes, and it is hoped that an improved cane will soon emerge from his operations. It is, however, essential that arrangements be made in the Deccan for the testing of a huge number of Coimbatore seedling canes, from the very early stages in the evolution of these canes. It is suggested that these operations should form an important integral part of this Research Scheme.

III—Water-requirements of Sugarcane and Rotation Crops.—A good deal of field experimental work has been done on the water-requirements of sugarcane while very little has been done on other crops. This is a subject which requires searching investigation of a much more exact character than is possible in fixed experiments. One of the bases on which the water-requirements of a crop depends is the water requirements of a fully developed single plant. When this is known and when the unavoidable losses due to evaporation and drainage, etc., have been accurately determined it is possible to form a fairly correct estimate of the requirements of an acre of crop. The general tendency in the Deccan, as in other parts of India, is to overwater the crop; and this is particularly so with sugarcane. It is, however, a matter of great importance to Government that water which costs so much shall not be wasted in this way.

Then there is the fact that the brix of cane juice varies with the method of irrigation, but this requires further detailed investigation.

Hence there is a big field for valuable research by a plant-physiologist in determining the water requirements of crops, both in the aggregate and at different periods of growth.

IV—Manurial-requirements of the Sugarcane Rotation.—Irrigated crops demand manure and there is a great field for determining the most suitable fertilizers, the quantities per acre and the mode and time of application. A good deal of field experimental work has been done, especially in connection with sugarcane. It is widely held that the agriculturist over-manures his cane. Formerly top-dressings of three or four hundred lbs. of nitrogen per acre of cane were usual and even now, with a depressed gul market, it is found that top-dressings of 250 lbs. of nitrogen per acre are being applied. Here again there is a wide field for research by a physiologist who would determine the precise quantities of nitrogen absorbed by normally developed plants and the ultimate destination of the manure applied to the land in other words what is taken up by the crop and what is drained away in the water and what becomes dissipated and what remains over in the soil. Manure also reacts upon the quality of certain products such as gul. This also demands research.

V—Improved Cultural Methods.—The method of growing sugarcane has been transformed as the result of investigations on the Manjri Farm. The old method consisted of short shallow furrows 2 to 2½ feet apart, enclosed in beds, requiring 18,000 sets per acre. The new method consists of long furrows ranging from 3½ to 5 feet apart according to circumstances and requiring 10,000 sets. Work is also in progress to determine the best way to grow cotton under irrigation. But there is still much scope for useful investigation, e.g., the best dates for sowing crops like cotton and groundnuts require further investigation.

VI—Sugarcane Economics.—Cost of production of sugarcane is a matter of vital importance. The cost of producing cane is high in these tracts. If the Deccan is to compete with Northern India as a sugar producer it is necessary to bring down the cost of cane. The "Manjri System" of cultivation has already achieved considerable success in this direction. In particular there is a great reduction in the amount of manure used, e.g., the nitrogen in the top-dressing is, 150 lbs. per acre as against 250 and above on cultivators' fields. This quantity of nitrogen, 150 lbs. has for the last 5 years has been associated

with yields of 9,723 lbs of gul (39 pallas) per acre on the Manjri Farm as against 9,867 lbs. obtained from top-dressings of 300 lbs. of nitrogen. Experiments are in progress with still smaller doses of nitrogen. It is obvious that the optimum dose must depend upon the market prices of fertilizers and of gul. Further investigation along these lines is required and the work should be extended to other important crops like cotton, wheat and groundnuts.

Every effort is also necessary to reduce the labour bill by substituting bullock power for manual power wherever possible.

Again farm yard manure is very scarce in many localities and in such places sann grown as a green manure is found to be more economical. Other green manures like daincha are under investigation.

Another field for investigation is the possible association of some form of stock farming with crop growing in the canal tracts. Promising results are being obtained with berseem (Egyptian clover) and this makes an excellent fodder for dairy buffaloes. Experiments on a substantial scale would yield very valuable information and might lead to the adoption of "mixed farming".

The best plan of management for a holding depends to a considerable extent upon its size. A practice which is suitable for a peasant holding may not be suitable on a large holding, and here again there is scope for useful work.

VII—Agricultural Requisites.—Much useful work has been done on field implements, especially ploughs and on crushers, both bullock-power and engine-power. The field for further investigation is wide.

Experiments have been commenced in manufacturing synthetic manure from the trash and cane stubbles, but further investigation is necessary.

THE SCHEME.

It should be obvious from what has been said that the problem of sugarcane, and its rotation crops, in the Deccan Canal tract, is one which can only be tackled adequately on a wide front. A simultaneous attack should be made in the following spheres :—

1. Soil-physics
2. Sugarcane physiology.
3. Sugarcane breeding.
4. Economics.

As regards sugarcane breeding it has already been pointed out that the primary stage (including hybridization) can probably best be carried out at Coimbatore by the Imperial Sugarcane Expert, but the rest of the work including the testing of seedling canes should be carried out in the Deccan. This testing work can accordingly suitably be included in the programme of the agriculturist officer who deals with the Economics Section. Hence it is proposed to organize this research scheme on the basis of one highly qualified officer assisted by two colleagues. These three officers will deal with soil-physics, sugarcane physiology and agriculture-proper respectively. The important details of

- | | |
|----------------|--------------------|
| 1. Site ; | 4. Equipment ; and |
| 2. Staff ; | 5. Estimates. |
| 3. Buildings ; | |

are dealt with below and it is suggested that the period of the scheme should be five years in the first instance.

SITE.

It is necessary that a site be chosen which is representative of the following environmental conditions of the Deccan Canals tract—

Soil

Rainfall

Temperature

Humidity

and that there should be adequate perennial irrigation facilities.

The Sugar Committee considered that Manjri, where the Department has its Experimental Farm, does not sufficiently provide these conditions and that a more representative site on one of the larger canals should be selected. The most suitable locality is considered to be in the vicinity of *Phaltan* or *Malsiras* on the New Nira Right Bank Canal.

One of the special factors in the situation in the diversity of the soils met with in the tract and it is important that the chosen site should include representative types.

It is considered that provision should be made for 30 acres of cane annually so as to provide for the large programme of work that is contemplated and to permit of repetition of some of this work on different soil-types. For these reasons a plot having an area of not less than 100 acres will be required.

STAFF.

As already indicated it is proposed to set up a temporary organization consisting of three sections, as noted below, each in charge of an officer. The senior officer would in addition be responsible for the whole scheme:—

I. Agriculture-proper.

II. Soil-physics.

III. Sugarcane-physiology.

These sections would require the following staff:—

	Rs.
<i>Staff required in the Agricultural Section proper:—</i>	
1 Officer in class I, Provincial Agricultural Service starting on .. ' ' ' .. ' ' ' .. ' ' ' ..	1,000
3 Graduate Assistants—	
1 Senior in Grade I, Subordinate Agricultural Service (Rs. 220—10—300) starting on .. ' ' ' .. ' ' ' ..	230
1 Junior in Grade III, Subordinate Agricultural Service (Rs. 105—5—140) starting on .. ' ' ' .. ' ' ' ..	125
1 Junior in Grade III, Subordinate Agricultural Service (Rs. 105—5—140) starting on .. ' ' ' .. ' ' ' ..	105
3 Non-graduate assistance in the grade of Rs. 30—5|2—00	
1 Starting on .. ' ' ' .. ' ' ' .. ' ' ' ..	50
1 Starting on .. ' ' ' .. ' ' ' .. ' ' ' ..	45
1 Starting on .. ' ' ' .. ' ' ' .. ' ' ' ..	30
1 Store-keeper on Rs. 30—5|2—80 starting on .. ' ' ' .. ' ' ' ..	55
1 Engine driver on .. ' ' ' .. ' ' ' .. ' ' ' ..	60

Rs

Staff required in the Soil-physics section.—

1 Officer in class I of the Provincial Agricultural Service starting on	400
2 Graduate Assistants—	
1 Senior in Grade I of Subordinate Agricultural Service (Rs 220—10—300) starting on	220
1 Junior in Grade II, Subordinate Agricultural Service (Rs 150—5—200) starting on	150
1 Non-graduate Assistant on Rs 30—5½—80 starting on ..	40
2 Laboratory boys on Rs 18 per mensem starting on ..	18

Staff required for the Sugarcane-physiology Section:—

1 Officer in class I of the Provincial Agricultural Service starting on	400
1 Graduate Assistant of Grade I, Subordinate Agricultural Service (Rs 220—10—300) starting on	220
2 Non-graduate Assistants (Rs. 30—5½—80) starting on ..	40
2 Laboratory-boys on Rs 18 per mensem starting on ..	18

Staff required in office section —

1 Head clerk accountant on Rs. 105—5—140 starting on ..	105
1 Junior clerk on Rs 30—5½—80 starting on	40
1 Naik on Rs. 20	20
3 Peons on Rs 15	18
2 Watchmen on Rs 20	20

BUILDINGS.

It is presumed that the three officers would find their own quarters in the neighbourhood and that the graduate staff in the Soil-physics and Sugarcane-physiology sections would do likewise.

This leaves the following staff to be provided for in kuteha buildings to be erected at the plot site:—

- 3 Graduate assistants,
- 6 Non-graduate assistants,
- 2 Clerks,
- 2 Laboratory-boys, storekeeper and engine driver.
- 6 Peons and watchmen.

Laboratory and Office.—Accommodation on the site of the plot would be required for the laboratory and office in a temporary building.

Gurhal shed.—A suitable shed to accommodate the sugarcane mill and engine and the furnaces will be required.

Miscellaneous.—Kuteha buildings for cattle, implements stores and coolies will be required.

EQUIPMENT.

The following equipment would be required :—

- I. Livestock and Deadstock.
- II. Land-improvements, including fencing.
- III. Laboratory fittings and apparatus.

ESTIMATES.

The estimated cost of this scheme is given in summary below while the details will be found in

<i>Non-recurring Expenditure.</i>			Rs.	Appendix A, from which it will be seen that the total cost for a five-year period will amount to Rs. 5,22,088 made up of Rs. 67,018 non-recurring and Rs. 4,54,170 recurring. The Department of Agriculture is in a position to contribute Rs. 1,30,850 made up of Rs. 6,105 non-recurring and Rs. 1,24,745 recurring as shown in the margin.
Item.	Value in rupees.			
Livestock	2,121			
Implements	2,000			
Bullock-mill	250			
Weighing machines	300			
Office-furniture	745			
Laboratory fittings	680			
			6,105	
<i>Recurring Expenditure.</i>			Rs.	
Item.	Amount in rupees for five years.			
Pay of establishment for five years	52,370			
Travelling allowance	2,375			
Contingencies	70,000			
			1,24,745	
Total contribution by the Bombay Department of Agriculture ..			1,30,850	

SUMMARY ESTIMATES OF COST.

Non-recurring Expenditure.

Item.	Rs.	Rs.
(1) Buildings	31,650	
(2) Equipment as under :—		
	Rs.	
(a) Livestock and deadstock	21,670	
(b) Land improvement	4,508	
(c) Laboratory fittings and apparatus	10,000	
		36,268
		67,918

Recurring Expenditure.

Item.	Rs.
(1) Pay of officers	24,480
(2) Pay of Establishment	22,464
(3) Allowances and Honoraria	7,280
(4) Contingencies	30,610
	<hr/>
	90,834
Therefore for five years (90,834 × 5)	4,54,170
	<hr/>
Therefore total cost for five years	5,22,088

T. F. MAIN,

Director of Agriculture, Bombay Presidency.

Poona, 24th October 1930.

APPENDIX A.

DETAILED ESTIMATES OF COST.

The following statements give the detailed estimates of the scheme.

*Non-recurring Expenditure.**Building.*

Description.					Amount in rupees.
A. Residential (kutcha quality)					11,070
Type of person.	Number of persons.	Square feet allowed per person.	Total square feet required.	Rate per square foot in rupees.	Cost in rupees.
Graduate Assistants ..	3	553	1,659	1.5	2,490
Non-graduates and clerks.	8	475	3,800	1.5	5,700
Servants	12	160	1,920	1.5	2,880

B. Laboratory and Office (temporary quality) 9,918

Internal measurements in feet.	Name of building.
50 × 25	Laboratory.
20 × 25	Clerks' office.
12 × 25 × 3	3 Office rooms.

∴ allowing for partition walls 114 × 29 = 3,306 square feet at Rs. 3 per square foot.

C. Curhal and Engine shed 3,000
D. Miscellaneous (kutcha quality) 7,682

Type of building.	Area in square feet.	Rate per square foot.	Cost in rupees.
Cattle shed for 10 pairs ..	50 × 20 = 1,000	1.75	1,750
Implement shed	25 × 15 = 375	1.5	562
Storo	50 × 20 = 1,000	1.25	1,250
Coolie lines for 15 men ..	100 × 15 = 2,400	1.5	3,600
Manure pit .. ..	....	..	500

Total (buildings) .. 31,660

APPENDIX A—contd.

EQUIPMENT.

I—Livestock and Deadstock.

Serial Number.	Item.	Cost in rupees.
1	10 pairs of cattle at Rs. 350	3,500
2	Implements	2,000
3	Weigh-bridge and two weighing machines	2,100
4	Rain-gauge	50
5	One power cane crushing mill and oil engine and accessories	10,670
6	One bullock mill	250
7	Office-furniture	1,100
8	Reference books	1,000
9	Water-measuring devices	1,000

Total Livestock and Deadstock 21,670

II.—Land Improvements.

Serial Number.	Item.	Cost in rupees.
1	Fencing 8,348 feet at Rs. 1,900 per mile	3,098
2	Levelling land, etc., at Rs. 15 per acre	1,500

Total Land improvements 4,598

III.—Laboratory fittings and apparatus 10,000

Total (Equipment) .. 36,268

Total Non-recurring Expenditure .. 67,918

Name of head.	Budget estimates.					Remarks.
	1st year.	2nd year.	3rd year.	4th year.	5th year.	
1	2	3	4	5	6	7
<i>Pay of officers.</i>	<i>Staff required in the Agricultural Section proper.</i>					
One officer in class I Provincial Agricultural service (Rs. 320—40—1,200) starting on Rs. 1,000 per mensem	12,000	12,480	12,960	13,440	13,920	
<i>Pay of establishment.</i>						
Three graduate assistants as under :—						
One Senior in Grade I, Subordinate Agricultural Service (Rs. 220—10—300) starting on Rs. 230 per mensem ..	2,760	2,880	3,000	3,120	3,240	
One Junior in Grade III, Subordinate Agricultural Service (Rs. 105—5—140) starting on Rs. 125 per mensem	1,560	1,560	1,620	1,680	1,680	
One Junior in Grade III, Subordinate Agricultural Service (Rs. 105—5—140) starting on Rs. 105 per mensem	1,260	1,320	1,380	1,440	1,500	
Three non-graduate assistants in the grade of Rs. 30—5/2—80 as under :—						
One starting on Rs. 50 per mensem ..	600	600	660	660	720	
One starting on Rs. 45 per mensem ..	540	540	600	600	660	
One starting on Rs. 30 per mensem ..	360	360	420	420	480	
One store-keeper in the grade of Rs. 30—5/2—80 starting on Rs. 55 per mensem ..	660	660	720	720	780	
One Engine Driver on Rs. 60 per mensem ..	720	720	720	720	720	
	8,400	8,640	9,120	9,860	9,780	

Name of head.	Budget estimates.					Remarks.
	1st year.	2nd year.	3rd year.	4th year.	5th year.	
	2	3	4	5	6	
1						7
<i>Staff required in the Soil-Physics section.</i>						
<i>Pay of officers.</i> One officer in class I of the Provincial Agricultural Ser- vice (Rs. 320—40—1,200) starting on Rs. 400 per men- sem	4,500	5,280	5,760	6,240	6,720	
<i>Pay of establishment.</i> Two graduate assistants as under :— One senior in Grade I of Subordinate Agricul- tural service (Rs. 220 —10—300) starting on Rs. 220 per men- sem	2,640	2,760	2,880	3,000	3,120	
One junior in Grade II of Subordinate Agricul- tural Service (Rs. 150 —5—200) starting on Rs. 150 per mensem ..	1,800	1,800	1,920	1,990	2,040	
One non-graduate assis- tant on Rs. 30—5/2 —80 starting on Rs. 40 per mensem ..	180	180	340	540	600	
Two Laboratory boys on Rs. 18 per mensem each	132	432	432	432	432	
	5,352	5,332	5,772	5,932	6,192	
<i>Staff required for the Crop-physiology section.</i>						
<i>Pay of officers.</i> One officer in class I of the Provincial Agricultural Service (Rs. 320—40— 1,200) starting on Rs. 400 per mensem	4,800	5,280	5,760	6,210	6,720	

Name of head.	Budget estimates.					Remarks.
	1st year.	2nd year.	3rd year.	4th year.	5th year.	
1	2	3	4	5	6	7
<i>Pay of establishment.</i>						
One graduate assistant of Grade I in Subordinate Agricultural Service (Rs. 220—10—300) starting on Rs. 220 per mensem ..	2,610	2,760	2,880	3,000	3,120	
Two non-graduate assistants on Rs. 30—5/2—80 starting on Rs. 40 per mensem each	960	960	1,080	1,080	1,200	
Two Laboratory boys on Rs. 18 per mensem each ..	432	432	432	432	432	
	4,032	4,152	4,392	4,512	4,752	
<i>Staff required in office section.</i>						
<i>Pay of establishment.</i>						
One head clerk Accountant on Rs. 105—5—140 starting on Rs. 105 per mensem	1,260	1,320	1,380	1,440	1,500	
One junior clerk on Rs. 30—5/2—80, starting on Rs. 40 per mensem	480	480	540	540	600	
One naik on Rs. 20 per mensem	240	240	240	240	240	
Three peons on Rs. 18 per mensem each	648	648	648	648	648	
Two watchmen on Rs. 20 per mensem each	480	480	480	480	480	
	3,108	3,168	3,288	3,348	3,468	
Grand Total ..	42,492	44,532	47,052	49,092	51,552	
Total pay of officers ..	21,000	23,040	24,480	25,020	27,300	Total 1,22,400
Total Pay of Establishment	20,892	21,492	22,572	23,172	24,192	„ 1,12,320

Name of head. 1	Budget estimates.					Remarks. 7
	1st year. 2	2nd year. 3	3rd year. 4	4th year. 5	5th year. 6	
<i>Allowances and Honoraria.</i>						
Travelling allowance as under :— Rs. 2,000 Agricultural Section. 1,000 Soil Physics Section. 500 Crop Physiology Section.						
3,500 Total ..	3,500	3,500	3,500	3,500	3,500	
Conveyance allowance as under :— Three officers in Class I, Provincial Agricultural Service at Rs. 75 per mensem each (Rs. 2,700).	3,780	3,780	3,780	3,780	3,780	
Three graduate assistants in the Soil Physics and Crop-Physiology sections at Rs. 30 per mensem each (Rs. 1,080).						
	7,280	7,280	7,280	7,280	7,280	36,400

Contingencies.

Serial Num- ber.	Item.	Amount in Rupees.
1	Cultivation and management of plot	23,000
2	Rent of land 100 acres at Rs. 35 per acre	3,500
3	Office and miscellaneous incidental expenditure	1,000
4	Service stamps	300
5	Soil-Physics section	5,000
6	Sugarcane physiological section	3,000
7	Current repairs to buildings 3 per cent. on Rs. 27,000	810
	Total contingencies	36,610

APPENDIX XII.

APPOINTMENT OF VETERINARY RESEARCH OFFICERS IN THE PROVINCES :—

- (a) SCHEME FOR RESEARCH INTO THE PROTECTION OF BUFFALOES AND CATTLE FROM HAEMORRHAGIC SEPTICAEMIA BY THE BACTERIOPHAGE METHOD IN BENGAL. (ENCLOSURE I.)
- (b) APPLICATION FOR A RECURRING LUMP SUM GRANT FOR THREE YEARS TO COVER THE PAY OF A RESEARCH OFFICER AND EQUIPMENT TO INVESTIGATE THE CAUSES OF CONTAGIOUS DISEASES IN ANIMALS IN THE CENTRAL PROVINCES. (ENCLOSURE II.)

The Governments of Bengal and the Central Provinces have submitted Schemes of research (Enclosures I and II) on the subjects noted above with application for grants of Rs. 1,07,400 and Rs. 40,200, respectively, the expenditure in each case being spread over a period of three years. In this connection the Animal Husbandry Expert Adviser to the Council has sketched out a scheme (Enclosure III) for the appointment of veterinary investigation officers in each province which will, if found feasible, replace isolated schemes of veterinary research such as those put forward by Bengal and the Central Provinces and thus give an impetus in all provinces to veterinary research on co-ordinated lines. The schemes from the two provinces as well as the general scheme are now for the consideration of the Advisory Board.

M. S. A. HYDARI,

Secretary.

The 10th December 1930.

LESLIE

ENCLOSURE I.

Copy of letter No. 5181, dated the 13th November 1930, from the Secretary to the Government of Bengal, Agriculture and Industries Department, Calcutta, to the Secretary, Imperial Council of Agricultural Research.

1.

2. I am to request that the following scheme* which was approved at the first meeting of the Bengal Agricultural Research Committee and forwarded with this Department letter No. 268-T. A. I., dated the 3rd June 1930 and which is still outstanding may be carried forward for consideration at the January meeting of the Advisory Board.

LETTER FROM P. J. KERR, Esq., I.V.S., VETERINARY ADVISER TO THE GOVERNMENT OF BENGAL, TO THE SECRETARY TO THE GOVERNMENT OF BENGAL, DEPARTMENT OF AGRICULTURE AND INDUSTRIES, No. 797/A-85-V.D.A., DATED CALCUTTA, THE 12TH MARCH 1930.

I have the honour to submit an application for an allotment of funds from the Imperial Council of Agricultural Research for the purpose of engaging a Specialist Officer to undertake research into the "Protection of Buffaloes and Cattle from Haemorrhagic Septicæmia by the Bacteriophage method."

2. This disease is prevalent throughout India and causes heavy losses annually in the water districts of Bengal. The figures for the last three years are as follows :

				Outbreaks reported.	Deaths reported.
1926-27	..	..	..	59	1,507
1927-28	..	..	..	85	1,928
1928-29	..	..	..	156	3,202

3. These figures do not represent the total losses as in many cases seats of outbreaks cannot be visited, and so outbreaks are not verified. And there must be a number of smaller outbreaks and deaths not reported at all for various reasons.

4. The present methods of combating this disease are (a) Serum Alone method and (b) Vaccine method.

(a) The Serum Alone method confers immunity of very short duration and for it to be successful every animal within the affected area must be inoculated in the course of a few days. This is not possible with the limited staff available, even if the owners were all willing. There can be no compulsion, and persuasion means more time and more staff. The necessity for re-inoculation after a week if the outbreak persists is a great handicap. It is, however, the only method at present applicable in the face of widespread outbreaks.

(b) Vaccine treatment.—This method does not confer immunity immediately, several days elapse before the protection is acquired. It is therefore not suitable for combating outbreaks but can be used as a prophylactic method. Here again its utility is limited as the protection given only lasts for about two months, whereas the Haemorrhagic Septicæmia season lasts 4-5 months. The methods referred to above can be combined but that means double work, requires more staff and the immunity conferred lasts only for two months. Serum costs 6 annas a dose.

5. Bacteriophage.—The chief benefit of this method, to the best of my knowledge, is the cheapness of its production and the ease with which it can be applied. It is essentially a treatment to be used at the time of outbreaks, but

*Scheme for engaging a specialist officer for research into Protection of Buffaloes and Cattle from Haemorrhagic Septicæmia by the Bacteriophage method.

it is not yet known for what period the immunity conferred lasts. It is also a curative measure for affected animals.

Should this method prove satisfactory Government would be saved considerable expenditure and the results to cattle owners would be infinitely more beneficial.

6. While this Specialist Officer is engaged in Bengal, I propose that a suitable officer should be posted under him for training in research, who would be qualified on completion of the Specialist's term to carry on the work on the lines adopted, and also take up fresh subjects for research. This help given by the Research Council will thus be twofold. It will help to investigate an urgent problem affecting the whole of India, and at the same time enable Bengal to help itself in such matters in future.

7. We have an officer in the Provincial Service, who is suitable for training under the Specialist, and has had the preliminary education necessary. At the Bengal Veterinary College there is a suitable laboratory to serve as the headquarters of the Specialist.

8. The approximate cost of the scheme will be as follows :—

	First year. Rs.	Second year. Rs.	Third year. Rs.
Pay of Specialist Officer (Rs. 1,000—50—1,100) ..	12,000	12,000	13,200
His travelling allowance at Rs. 500 per month ..	6,000	6,000	6,000
Pay of his peon at Rs. 15 per mensem	180	180	180
House allowance as per Calcutta House Allowance Scheme	3,000	3,000	3,000
Pay of his Assistant under training (Rs. 350—20—390)	4,200	4,440	4,680
Pay of peon of the Assistant under training at Rs. 15 per month	180	180	180
Travelling allowance of two peons at Rs. 25 each per month	600	600	600
Purchase and keep of animals	2,000	2,000	2,000
Contingencies	1,000	1,000	1,000
Passage for Specialist Officer	1,000	1,000	1,000
Total	30,160	31,000	31,840
(Overseas pay of the Specialist Officer at £30 per month)	£300	£300	£360

ENCLOSURE II.

COPY OF LETTER FROM THE REVENUE SECRETARY TO GOVERNMENT, CENTRAL PROVINCES, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. 1371-543-XIV, DATED THE 3RD NOVEMBER 1930.

SUBJECT :—*Application for a recurring lump grant for three years to cover the pay of Research Officer and equipment.*

I am directed by the Government of the Central Provinces (Ministry of Agriculture) to address the Imperial Council of Agricultural Research for financial assistance in connection with a scheme for the investigation of numerous parasitic infections which are prevalent throughout the province.

2 There has been a marked increase in the mortality of cattle in this province from contagious diseases for the last few years. Investigations carried out by the Veterinary Department in various villages showed that 85 per cent of the animals in those villages were affected with piroplasms of some kind but the true extent of the infection in the province as a whole and the economic loss entailed by such infection have not so far been investigated. The two diseases reported periodically from the districts are Tiwa and Bhowri. The former appears to incapacitate working bullocks for some time while the latter is known to be sometimes fatal. In addition to the above there are numerous parasitic infections prevalent in the province which received very little attention so far for want of an officer who could undertake the work.

3. A large number of specimens are received annually in civil Veterinary Department Laboratory, Nagpur, for examination and report, but the sanctioned staff of one officer of the Central Provinces Veterinary Service, class II, and one Veterinary Assistant Surgeon which is fully occupied with the routine work is unable to render any assistance to the field staff in combating these obscure epidemics which require a whole-time officer for their investigation.

4. I am to add that Central Provinces is a suitable area for the research of epidemic diseases and the results achieved when published would be of all India importance and benefit the workers and stock owners throughout the country. I am accordingly to request that Imperial Research Council will be so good as to assist this Government by a recurring lump grant of Rs. 16,400 for three years commencing from the year 1931-32 to cover the pay of Research Officer and equipment as shown below :—

	Rs.
(1) Salary of officer on three years contract at Rs. 1,000 per mensem.	12,000
(2) Two peons	400
(3) Chemicals, microscopes, etc.	4,000
Total	16,400

ENCLOSURE III.

Note by the Animal Husbandry Expert Adviser to the Imperial Council of Agricultural Research.

After careful consideration of the whole matter I have come to the conclusion that what is required is a research organisation covering the whole of India, based on Muktesar, where the work is now being divided into definite sections, suitable for working in collaboration with a veterinary investigation staff in each province. If appointed this staff would be constantly engaged in studying local conditions in the field and would supply the necessary information and material for systematic record and research at Muktesar.

India is such a vast country and the conditions are so variable that without such an organisation I feel that it will be difficult to obtain the maximum of practical benefit from the research work done at Muktesar. The present backward position of India, in the matter of serum-simultaneous inoculation against Rinderpest, is a very good instance of the paralysing effect of the totally inadequate provision which has been made India in the past for disease investigation, which is essential to efficiency.

There is no necessity for large institutes in provinces for this work and from what I have seen I think each province would be able to provide sufficient accommodation without any considerable expenditure on buildings. In view of the present financial stringency, however, there is no prospect of disease investigation officers being employed by provincial Governments in the near future, and I recommend that a small veterinary investigation staff for each province be paid for by this Council for 5 years, in provinces where no such staff now exists.

By the collaboration of this staff with Muktesar we should be able, during that time, to obtain a fairly complete survey of disease conditions throughout India, which at present does not exist, as well as being in a far better position than now to apply the latest methods of disease control.

At the end of 5 years, it may be anticipated that provinces will have realised the necessity for the permanent provision of such staff and facilities, but if provincial funds are still not available, I can think of no better way for the Imperial Council of Agricultural Research to assist the live-stock industry of this country.

With such an organisation in being and scientifically controlled, Directors of Veterinary Services and stock-owners would have some one to turn to for immediate help in dealing with their disease problems and we should at the same time, be training suitable young officers in practical disease investigation in the field, which must always be the first step in control in any country.

I consider that one veterinary investigation officer, with adequate assistance, should be provided at once for each of the following provinces and presidencies, where at present no such staff exists, *viz.*, Bengal, Assam, Bombay, Central Provinces, United Provinces, and one for Sind, where special problems require to be studied, owing to the extension of irrigation to large additional areas.

The Punjab and Burma already have Research Officers and need not be considered at the moment, though in view of the large area covered and the necessity of providing for N. W. F. P., I think an Assistant Veterinary Investigation Officer would be justified for the former.

In the case of Madras, where disease investigation has been more thoroughly dealt with in the past than elsewhere, the proposal now put up for a Toxicologist* should be supported, so that poisoning by plants may be dealt with at the same time as microbial diseases, for the benefit of India as a whole.

The staff required for each province would, I think, be one Veterinary Investigation Officer, one Laboratory Assistant, one Stenographer, one Laboratory

*NOTE.—Proposal not officially received.

servant and two peon which, if the provinces provide the necessary accommodation and equipment, should cost the Imperial Council of Agricultural Research approximately Rs. 10,000 per province per annum.

On this basis the total cost to the Imperial Council of Agricultural Research of the whole proposal would be Rs. 80,000, which in my view, would be thoroughly justifiable expenditure by that Council.

This disease investigation personnel, when appointed, should be borne on the staff of the Director of Veterinary Service of the province concerned, and should work under his supervision, in collaboration with Mukhtar, making full use of provincial funds for the investigation of special local problems and for testing new methods in the field, and I feel sure that the expenditure involved would be amply repaid in the results obtained.

Provinces, some officially, others informally, have requested us to grant assistance for the investigation of their particular disease problems, as follows:—

Beragal and Assam.—Hemorrhagic Septicemia.

Madras.—Poisonous plants.

C. P.—Helminthology and Parasitosis.

T. P.—Helminthology and Coccidiosis.

Poorbhoo.—Blackquarter and Anthrax.

In addition Ringworm and Foot and Mouth disease, Bloodquarter, Anthrax, Surra, Rabies, Mange and numerous unclassified diseases of sheep, goats and fowls require further investigation everywhere and I feel that the only method by which tangible results will be obtained, within a reasonable time, is to organize the work as suggested above.

A. OLIVER, Col.

. APPENDIX XIII.

Investigations on (1) virus diseases of plants and (2) physiologic forms of wheat rust in Bombay.

Attention is invited to the letter (Enclosure I) from the Government of Bombay, No. 4675-A/28, dated the 21st May 1930, on the subject of investigations on virus diseases of plants and physiologic forms of wheat rust. The schemes, which are fully explained in the application forwarded by the Government of Bombay, involve expenditure of Rs. 4,350 non-recurring and Rs. 99,360 recurring over a period of 5 years. A note (Enclosure II) on the second (rust research) scheme by Dr. K. C. Mehta, Professor of Botany, Agra College, who is at present engaged with the financial aid of the Council on an investigation of cereal rusts, is also enclosed.

M. S. A. HYDARI,

Secretary,

ENCLOSURE I.

LETTER FROM THE ACTING CHIEF SECRETARY TO THE GOVERNMENT OF BOMBAY, REVENUE DEPARTMENT, TO THE SECRETARY TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 4075-A/25, DATED THE 21ST MAY 1930.

SUBJECT :—*Investigations on virus diseases of plants and physiologic forms of wheat rust.*

I am directed by the Government of Bombay (Transferred Departments) to forward an application from the Director of Agriculture for a grant-in-aid of Rs. 1,03,710 for investigations on virus diseases of plant and physiologic forms of Black rust fungus of wheat on the lines of the schemes drawn up by the Plant Pathologist. I am to add that the Government of Bombay support the application and trust that it will receive favourable consideration at the hands of the Imperial Council of Agricultural Research.

LETTER FROM THE DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, POONA, TO THE CHIEF SECRETARY TO GOVERNMENT, REVENUE DEPARTMENT, BOMBAY, No. 493 of 1930, DATED THE 5TH APRIL 1930.

SUBJECT :—*Application to the Imperial Council of Agricultural Research for grant-in-aid for schemes on Virus Diseases.*

I have the honour to forward herewith copy of letter No. F. 74/370 of March 29th, 1930 from the Plant Pathologist to the Government of Bombay (Dr. B. N. Uppal) and a scheme drawn up by him for co-operative investigation on virus diseases of plants and another on physiologic forms of black rust fungus of wheat. I have the honour to request that these schemes may be put before the Imperial Council of Agricultural Research at their next meeting and I trust that the amount required will be sanctioned. There is little need to plead the necessity for investigation of virus diseases. These diseases are receiving a large amount of attention throughout the whole world and one of the South American States recently offered a very valuable money prize for work on virus diseases of sugarcane. Work in India on these diseases has so far been conspicuous by its absence with the exception of certain work on sugarcane. But the presence of virus diseases in a great number of crops is obvious even to the casual observer. The chilli crop on which some of the work is to be done is an extraordinarily important and valuable crop throughout the Presidency. Cardamom is similarly a very valuable crop and 'bhendi' offers opportunities for study which will undoubtedly give important scientific results.

With regard to the research on the physiologic forms of black rust fungus of wheat, I would like to insist on the fact that although a very substantial subvention has been given by the Imperial Council of Agricultural Research to Dr. Mehra for work on wheat rust his investigation is of a totally different character dealing with the way in which the rust fungus is carried over from year to year, while the research now proposed deals with another problem and one of vital importance not only to plant pathologists but also to plant breeders and to farmers. I think, therefore, that the fact that one worker has already been subsidized for work on wheat rust should not prevent other workers being subsidized for the study of totally different aspects of the problem. I would also like prominently to bring to your notice the co-operative nature of this research. This co-operation is in accordance with the best principles of modern science and brings to bear on these two problems the concentrated efforts of three highly equipped men. Dr. B. N. Uppal is B. Sc. of the Punjab University and D. Sc. of Iowa. Dr. V. N. Lakhite is B. A. B. S., (Bom.) and D. Sc. of Strasbourg and has experience in work in Holland and America. Mr. J. F. Dastur is M. Sc. (Bom.) and D. I. C. (Lond.). These three scientific workers with their differing out-

look and equipment but with a single aim should therefore be able to do effective works towards the rapid clearing up of the problems which they now propose for assistance from the Imperial Council of Agricultural Research. The researches will be under the administrative control of Dr. B. N. Uppal, i.e., will be under the Bombay Government (the other two workers being collaborators) and the headquarters will be Poona, the laboratory being in the Poona College of Agriculture.

I would ask you to forward these schemes as early as possible with your strong recommendation for the necessary gift of money. The Imperial Council of Agricultural Research is to meet in Simla in the end of May and it is desirable that these schemes should be forwarded to the Secretary, Imperial Council of Agricultural Research, without delay. I am sending one advance copy of both the schemes and also a copy of this letter to the Secretary, Imperial Council of Agricultural Research, for information.

Copy of letter No. F-74-370, dated 29th March 1930, from the Plant Pathologist to Government, Bombay, Poona, to the Director of Agriculture, Bombay Presidency, Poona.

SUBJECT :—Research schemes on (1) virus diseases and (2) the physiologic forms of wheat rust.

With reference to your letter No. 493, dated 5th December 1929, I have the honour to enclose herewith two schemes, and to request that you will be good enough to approach the Imperial Council of Agricultural Research for a grant-in-aid for carrying out research on these schemes. I also beg to state that the co-operation of Dr. V. N. Likhite, Director of Agriculture, Baroda, and Mr. J. F. Dastur, Mycologist to Government, C. P., Nagpur, has been arranged in connection with the schemes on virus diseases and the physiologic forms of wheat rust respectively, and that both these officers have obtained the permission of their respective Governments to collaborate with me in these investigations. It may, however, be noted that these officers will not, in any way, be responsible for the administrative control of the schemes; but they will fully collaborate with me in directing the research and by providing the necessary facilities in their provinces to the men engaged in the work.

2. I have enclosed detailed statements of the recurring and non-recurring expenditure for which it is requested that provision may be made for a period of five years in the first instance. It will also be noted that it is proposed to appoint a Special Mycologist, who will be in charge of both the problems. He will be assisted in his work by two Graduate Assistants, one in charge of each scheme. Since both the problems are of a highly technical nature, it will be necessary to appoint a well-trained person. The proposal that the Special Mycologist should be in charge of both the problems has certain advantages; it would enable us to effect a saving in the pay of the chief investigators (one for each scheme) who would ordinarily be required, as well as have a man of ripe experience in charge of the schemes. The headquarters of the Special Mycologist and his staff will be at Poona, where he will have adequate laboratory facilities at the Poona College of Agriculture. As regards investigation into the virus disease of cardamom, it will probably be necessary to do a major portion of this work at Sirsi, and I feel that it will be possible to make provision for a small laboratory there within the contingent grant of Rs. 3,000 per annum provided for in connection with the scheme on virus diseases.

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VIRUS DISEASES OF PLANTS.

(Co-operative Investigation between Dr. B. N. Uppal, Department of Agriculture, Bombay, and Dr. V. N. Likhite, Department of Agriculture, Baroda.)

Among the plant diseases, the virus diseases constitute one of the most important groups, and some of them have been known to be the most destructive. In recent years, this group of plant diseases has assumed considerable importance and as a result of extensive studies, our knowledge about these diseases has considerably been advanced; but their casual nature still continues to be obscure. In addition to the work on the casual agent, a great deal has been accomplished with regard to the dissemination of the virus diseases by such agencies as insects, seed, perennial parts of host plants and by perennial weeds. This subject offers a useful field of study, as by this means only, it is possible at this stage of our knowledge of these diseases to work out methods of control.

Excepting the work on sugarcane mosaic, no investigation of any importance has been made on the virus diseases in India. In fact, no survey of the virus diseases of the hosts of agricultural importance has ever been attempted in this country, and we are therefore quite in the dark as to the importance of these diseases in relation to our major crops. However, from the information available regarding some of these diseases it seems that they are causing great damage every year, and in certain cases have become limiting factors in the cultivation of these crops. It will therefore be seen that the work on the virus diseases of plants which we propose to undertake if a suitable grant-in-aid is sanctioned, is of great practical and scientific importance, as this field has been a neglected one in India, and it is high time that some beginning may be made to relieve the distress which, in some cases has become very acute.

We propose to divide our work into two parts: (1) a general survey of the virus diseases in the Bombay Presidency (we shall be willing to extend this work to the other provinces of India; but it will be done in collaboration with the Plant Pathologists of these provinces), and (2) investigations into specific virus diseases.

1. General Survey of virus diseases—

As has been pointed out above, very little is known regarding the virus diseases of important crops, and it is desirable that an extensive survey of these diseases be carried out. This should, however, be considered as a subsidiary part of the scheme which relates mainly to investigation into specific virus diseases of plants.

2. Specific virus diseases to be investigated—

In the first instance we propose to undertake investigation into the virus diseases of three crops, namely chillies (*Capsicum annum*), cardamom (*Elettaria cardamomum*) and Bhendi (*Hibiscus esculentus*). Before going into the importance of these diseases, it may be pointed out that we propose to investigate all the aspects of the virus diseases including pathological histology physiologic studies of the virus, insect or seed transmission wild plants as hosts harbouring the virus, transmissibility of the virus to other hosts, etc., and control measures.

(a) *Virus disease of chillies*.—Chillies, *Capsicum annum*, are grown extensively in the Bombay Presidency, covering an area of more than 150,000 acres. Generally chillies are grown as a dry crop in the Bombay Presidency, i.e., no irrigation is given and the crop is fed by the monsoon. The crop suffers from several diseases which are responsible for a great deal of damage, amounting, in some cases, to a total failure. In order to find out as to which of these diseases was the most serious to justify a detailed intensive study of it, an intensive survey of the most important chilli tracts in the Bombay Presidency was carried out in 1928. As a result of this survey it was found that the most serious disease of this crop was an obscure disease, which shows itself in reduced size

and curling of terminal leaves, the reduction of leaves being very pronounced in severe infection. In the early stages, the leaves also show mottling of the foliage; but this characteristic becomes less evident with the curling of the leaves. When infection is early, i.e., when the plants are affected in a seed-bed before they are transplanted, a very large number of flowers drop down, and a few form very small berries. If, however, there is late infection, blossoms develop into more or less normal fruits.

It was first thought that this affection was caused by mites, and the Bombay Department, of Agriculture recommended dusting with lime sulphur. This treatment was found effective when mites were involved; but it was found that dusting with lime sulphur did not invariably result in freeing the plants from infection. However, during the course of the survey in 1928, it was observed that in a very large number of fields examined all over the Presidency from Karnataka to Gujarat infestation with thrips was much more common than with mites. Further it was noticed that when thrips were present in very small numbers (this happens during the monsoon as the rain washes down the thrips, and acts as their natural enemy. However, these insects appear in large numbers in the latter part of the monsoon, i.e., about the end of September or the beginning of October. On the other hand, mites cause severe damage during the cool, rainy weather, and become less active at about the end of the monsoon season), the damage was very slight and the symptoms characteristics of the virus disease (as described above), were present. This led us to suspect that we were perhaps dealing with a virus disease, and that the thrips were vectors of the virus. Healthy chilli plants were raised in insect-proof muslin cages, and the virus-liferous insects collected from the affected plants in the field were introduced into a cage containing healthy plants (showing no mottling or reduced size of leaves). A control cage was provided with an equal number of healthy plants; but in this case no thrips were introduced on the plants. In almost all cases, the plants exposed to infection (by thrips) became diseased, whereas the plants in the control cage were normal even after 2½ months.

Following the experiment with thrips, attempts were made to effect transmission by means of the juice from diseased plants. Young leaves from diseased plants were removed and ground in a sterile mortar together with sterile distilled water. Five leaves of each of six healthy plants were then inoculated as follows: A leaf was supported by a wooden slip, and a drop of inoculum was dropped on it, which was then scratched or pricked through the drop with the point of a fine needle in a number of places, usually about 20 per leaf. About 50 per cent. of the plants thus treated showed mottling, whereas the control plants, i.e., plants which had received a similar treatment except that in place of the inoculum sterile water was used, all remained healthy. This experiment was repeated many times with similar results, thus showing that we were dealing with a virus disease.

Last year field trials were made to control thrips by means of Paris green (plus gulf) and nicotine sulphate. The results are inconclusive, as the disease did not appear and there was normal yield although thrips were present on the plants in as large number as in the previous years.

It will be seen from the above statement that the most destructive disease of chillies is a virus trouble; but the progress of work done in the last two and a half years has been far from satisfactory on account of the very meagre facilities available for this investigation. The total grant made available for this purpose by the Bombay Department of Agriculture amounted to Rs. 1,000 including Rs. 600 as the wages for one year of the person engaged to help in carrying out the work. Apart from the amount of work turned out, it is not proper to expect that a fresh man employed on Rs. 600 per year will be able to contribute something of a high order. In the case of the virus diseases where training counts far more than anywhere else, the chief requisite is to engage a man who has received fairly good training in plant pathology. It is not the routine work which he will be required to do, but he should be able to conceive the problem.

This disease has recently been reported from Burma and I think that it may also be found in the Madras Presidency where chillies are grown on a large scale. It may be present in Bihar and Orissa. In 'Fungi and Diseases in Plants' by E. J. Butler, a casual reference has been made to this disease (described as an obscure disease) as being the most serious disease affecting the chillie crop. Considering the All-India importance of this crop and its universal use by the people of this country, any disease which may affect the production of this crop, should engage our earnest attention, and we have evidence to believe that the virus disease of chillies falls in this category.

(b) *Virus disease of Hibiscus esculentus*.—Bhendī, *Hibiscus esculentus*, is a crop which is grown all over India, and is affected by a disease which is probably a virus disease. This disease has never been studied and we propose to investigate it thoroughly, as this disease has an all-India importance.

(c) *An obscure disease of cardamom resembling yellows (a virus disease)*.—The cultivation of the cardamom *Ellettaria cardamomum* is confined to the Western and Southern India. In the Bombay Presidency, it grows in the beautiful hill gardens of North Kanara. The crop is grown as a subsidiary crop in the spice gardens. It is usually free from diseases except that it becomes unhealthy due to an unknown cause. The diseased state of the plant is locally known as 'Katte'. The symptoms as described by Sahasrabudhe in the Bombay Department of Agriculture Bulletin No. 157 of 1929, are as follows: "the plants affected with *Katte* show a general lack of vigour. The stems are shorter and thinner than those of healthy plant, and the whole clump looks less packed together. The leaves though yellow as already described have no yellow spots. The flowering shoots are few in number and are generally very short. The new rhizomes produced are small and unhealthy. These appearances are usually hardly visible in the first two years of the growth of a plant in a garden, but in an affected place they become very marked in the third and fourth year. In the fifth year it usually does not pay to keep the affected plants longer and they are uprooted and thrown away while the rhizomes from unaffected plants are dug up, cut and planted in new places."

A brief account of the symptoms given above, though incomplete shows that the disease resembles the infectious chlorosis of asters known as 'yellows'. The stunting of the plant, the shortening of internodes, the dwarfing and reduction in the number of flowering shoots and the yellowing of leaves, are all characteristics of yellows. Sahasrabudhe thinks that the diseased condition in plants is brought about by the alkaline nature of the soil, which results from the alkaline material excreted by the protozoa which inhabit the affected soils. We are not convinced that such is really the case, and propose that the whole question should be re-investigated, as the disease is seriously affecting the economic position of cardamom cultivation in Kanara. As a result of this disease, the yield of cardamom has been reduced from 75 to 28 pounds per acre, and many of the plants which used to live for an indefinite period, die within two or three years after they begin to yield. The problem has an all-India importance as cardamoms are grown in restricted localities, and the failure of the crop in these localities will affect the price of this article which is used extensively by the people of this country. The importance of this investigation is therefore obvious.

PHYSIOLOGIC FORMS OF BLACK RUST FUNGUS OF WHEAT.

(Co-operative investigation between Dr. B. N. Uppal, Department of Agriculture, Bombay, and J. F. Dastur, Esquire, Department of Agriculture, Central Provinces.)

The discovery of the phenomenon of physiologic specialisation in the fungi is undoubtedly one of the most important developments in plant pathology. Perhaps the most classical example of this phenomenon is furnished by the fungus, *Puccinia graminis*. It has been shown that this fungus consists of composite group-forms or varieties such as *P. graminis tritici* on wheat, *P. graminis avenae* on oats and some grasses and *P. graminis secalis* on rye, barley and some other grasses but not on wheat or oats. It has also been shown by Stakman and others in the United States, that the wheat variety is composed of component strains, or physiologic forms. They have isolated and studied forty or more forms of *P. graminis tritici*. Some of the physiologic forms on wheat show slight morphological differences; but they are chiefly distinguished by their power of infecting different varieties of wheat, that is a variety of wheat may be immune from one or several physiologic forms of the rust fungus and susceptible to several others. There are varieties of wheat such as *Little Club* which is completely susceptible, and *Khaphi* which is extremely resistant to all the known physiologic forms in North America. However, in 1929 there was present in the breeding plots at Kirkee, Poona, a physiologic form to which *Khaphi* was highly susceptible. Further, it has been shown that several of the physiologic forms differ in their geographical distribution. Several factors affect the prevalence and distribution of these forms, and it is likely that the difference in the climatic conditions in the various parts of a country plays no small part in the distribution of these forms.

It will be seen from the foregoing statement that in any work on the breeding of varieties of wheat resistant to black rust, it is of primary importance to know the prevalence of the physiologic forms in the area in which the new types of wheat are to be grown. It is therefore necessary that a thorough survey of the physiologic forms of the wheat rust should be made in the principal wheat-growing areas of this country. Stakman and others have also shown the value of these surveys in the study of the epidemiology of black (stem) rust. That is to say they have suggested the possibility that the physiologic form survey may be used not only to explain certain facts in connection with the development of epidemics but also to predict the probable occurrence of epidemics. To explain more clearly, let us suppose that the only sources of infection in India are the barberries in the Himalayas, which produce aeciospores. Observations made in the United States have shown that the aeciospores are not carried any great distance from the infected barberry bush and that they are not able to withstand such adverse conditions, as urediniospores, so that infection of nearly grains and grasses must take place soon after they are discharged from the aecia. Therefore, the infection of grains and grasses by aeciospores is for the most part local or limited in area. From the primary infection on wheat, the stem rust spreads outwards by the succeeding generations of urediniospores, which can be carried by wind long distances. Thus the urediniospores reach the wheat crops in the plains in the United Provinces and the Punjab (a matter of about 25 miles), and by secondary spread by urediniospores, the spread of stem rust may be traced for miles. Now, if it were possible to determine the physiologic forms in the North (i.e., in the plains at the foot of the Himalayas), it would be of value in predicting the probability of rust epidemics in the United Provinces, the Central Provinces, the Kathiwar States, Gujarat and North Deccan. That is to say, if the forms of rust in the North in any given year are predominantly those which cannot attack the wheats in the Central Provinces, Gujarat, etc., there would be little to fear even if the weather conditions were favourable for the development of epidemic in these areas. However, if the forms of rust in the North were such as could attack wheat normally in the Central Provinces, Gujarat, etc., there would be likelihood of an epidemic if the weather conditions were favourable.

It has been pointed out above that for breeding rust resistant varieties of wheat for a given area, it will be necessary to know the physiologic forms prevalent in that area. In India, the work on the breeding of rust resistant wheats has been done without any reference to the forms, and indications are that some of the work done in the Bombay Presidency will prove a failure. For instance, resistant wheats developed at the Karkee Wheat Breeding Station have been found susceptible to rust when grown at Dhairwar. Why is it that even under normal conditions Pusa 4 becomes severely rusted in certain areas and not in others, and then again in certain years in the same area where it is normally resistant? I am afraid it may not be possible to explain all the facts on the basis of weather conditions as the only factor in determining the resistance or susceptibility of a variety of wheat under different conditions. This problem is one of the most important in the field of plant pathology, and unless a breeder is in possession of the necessary information about the relative prevalence and distribution of the physiologic forms in the different areas of this country, his work will be imperfect and may result in his labour of many years being wasted.

In order to determine the physiologic forms in different areas, the procedure to be followed will be somewhat as follows. A series of rust nurseries each consisting of a uniform set of wheat varieties, would be established at suitable points in the Bombay Presy., the Kathiawar States and the Central Provinces (the United Provinces and the Punjab will be included as the work progresses). A number of selected varieties of wheat would be grown at these nurseries every year, each variety to be grown in two or three rod rows. They would be allowed to become infected in the natural way. Specimens of fresh uredinial material would then be collected at each of these nurseries, and would be sent to Poona, where they would be used promptly to inoculate as many of the differential wheats as possible, grown in the greenhouse there (details of the greenhouse are furnished below (Enclosure I)). The reactions of the differential hosts would be tested and the identity of the physiologic forms would be determined by means of a key to be worked out like the dichotomous key used by Stakman and Levine in their studies.

It has been pointed out above that the discovery of physiologic specialisation in *Puccinia graminis tritici* has made the work of the Plant breeder more complex since now he must take into consideration a large number of physiologic forms with their differential reactions. As these forms vary in number, prevalence and severity from year to year in the same area, it is therefore reasonable to assume that certain factors influence the prevalence of the forms and thereby the development of rust epidemics in the area. Seasonal weather conditions appear to be an important factor; but an attempt to analyse the relation of this factor of the development of stem rust must take into consideration the effect of weather on all the phases of the life cycle of the rust, since the effect of weather on one phase of the life cycle may profoundly influence the development of another stage. We therefore also propose to study the relation of seasonal weather conditions to the development of rust epidemics in the wheat-growing areas.

It is requested that the schemes may be sanctioned for a period of five years, in the first instance, and the grant-in-aid required for five years for both the schemes will come to Rs. 1,03,710, the details of which are furnished below :—

Non-recurring Expenditure.

	Rs.
1: Greenhouse	2,000
2. One research microscope	750
3: Frigidaire model M.-12, capacity 12 cubic feet ..	1,600
Total ..	4,350

Recurring Expenditure.

Establishment.	1st year.	2nd year.	3rd year.	4th year.	5th year.
I. Pay—					
(1) Special Mycologist (Rs. 320—40—800).	3,840	4,320	4,800	5,280	5,760
(2) Clerk (40—5/2—80) ..	480	480	540	540	600
(3) Peon at Rs. 18 per mensem	216	216	216	216	216
Virus Diseases Scheme—					
(1) Graduate Assistant (Rs. 160—5—200).	1,800	1,860	1,920	1,980	2,040
(2) Non-Graduate Assistant (Rs. 40—5/2—80).	480	480	540	540	600
(3) Laboratory Boy at Rs. 18 per mensem.	216	216	216	216	216
Physiologic Forms Scheme—					
(1) Graduate Assistant (Rs. 160—5—200).	1,800	1,860	1,920	1,980	2,040
(2) Non-Graduate Assistant (Rs. 40—5/2—80).	480	480	540	540	600
(3) Laboratory Boy at Rs. 18 per mensem.	216	216	216	216	216
II. Travelling allowance—					
(1) Special Mycologist and his peon.	2,500	2,500	2,500	2,500	2,500
(2) Staff	500	500	500	500	500
III. Contingencies—					
Including apparatus, chemicals and cultivation charges—					
(1) Virus diseases scheme	3,000	3,000	3,000	3,000	3,000
(2) Physiologic forms scheme.	2,000	2,000	2,000	2,000	2,000
IV. Reserve	1,000	1,000	1,000	1,000	1,000
Total ..	18,528	19,128	19,908	20,508	21,288

Total for above (non-recurring and recurring) is Rs. 1,03,710.

ENCLOSURE I.

Greenhouse.—The details for building a green-house may be given as below :—

(1) Dimensions—15 × 30 ft.

(2) Glass roof and wooden trellis work on sides and Shahabad stone paving.

			Rs.	A.	P.
Roof — (glass panes 540 sq. ft.)	..	..	800	0	0
Trellis—(90' × 8' — 720 sq. ft.)	..	..	400	0	0
Brick pillars—(8 × 1½ × 1½ × 8)	..	..	60	0	0
Paving—(30' × 15' — 450 sq. ft.)	..	..	250	0	0
Wooden benches—(three)	..	..	75	0	0
Water basin	..	..	40	0	0
Piping (perforated) to make showers of rain	..	..	200	0	0
Finishing (paint, etc.)	..	..	100	0	0
Curtains (to protect from heat in summer)	..	..	100	0	0
Glass moist chamber	..	..	100	0	0
Muslin chambers for rust cultures and inoculation	..	..	100	0	0
Miscellaneous	..	..	275	0	0
			<hr/>		
			2,000	0	0

Frigidare.—This is a very essential piece of apparatus which will be used in connection with both the investigations. In the investigation on physiologic forms, the uredinal material has to be preserved in a cool place before it will be used for inoculating the differential hosts. While studying the physiology of the different plant viruses and in making cross-inoculation studies, the viruses should be kept in a cool place, as high temperatures inactivate them. The importance of this apparatus is therefore obvious.

Special Mycologist.—As has been pointed out in the forwarding letter, the advantage of appointing one man to hold charge of both the schemes is to effect saving in the pay as ordinarily two men will be required, and in this way it will also be possible to engage a well-trained investigator by offering him a better pay.

Clerk.—There will be considerable office work and it will not be possible for the office clerk of the Plant Pathologist to Government, Bombay, to help the Special Mycologist in typing reports, preparing contingent, pay and travelling allowance bills, and carrying on the normal correspondence which these investigations will make necessary.

Travelling allowance.—It will be necessary for the Special Mycologist to undertake extensive touring in the Bombay Presidency, the Central Provinces and the Kathiawar States in connection with both the investigations, and the provision of Rs. 2,500 for the Special Mycologist and his peon for this purpose will barely be sufficient. It may be noted that the Special Mycologist will be able to manage his work within this grant, since in his tours, he will be able to collect data bearing on both the problems. This arrangement will effect considerable saving on the travelling allowances.

The provision of Rs. 500 for the staff is very moderate.

Contingencies.—The sum of Rs. 5,000 per annum has been provided for contingencies under both the schemes, and this may be considered as the minimum requirement. These include many miscellaneous charges, and some of the important items may be shown as follows: (1) cost of maintaining the greenhouse at Poona; (2) cultivation expenses at the various rust nurseries in Bombay, C. P. and the Kathiawar states; (3) provision for labour; (4) cultivation expenses in connection with the virus diseases of chillies, *bhendi* and carda-

mom ; (5) maintaining a small laboratory at Sirsi for the virus disease of cardamom ; (6) cost of making insect proof muslin cages ; (7) cost of insecticides for the control of insect vectors ; (8) cost of transport of plant materials and specimens ; (9) sprayers, etc., (10) laboratory material including reagents for cytological work ; (11) seed and plant material for study ; (12) contingent charges of the office of the Special Mycologist including postage stamps, etc., etc., etc. In fact, the provision will represent the minimum requirement, and it will not be possible to reduce this figure.

Reserve.—A reserve grant of Rs. 1,000 per annum is provided as it is not always possible to make provision for unforeseen expenditures. If at the end of the year, a portion or whole of this grant is not used, it will lapse to the Imperial Council of Agricultural Research.

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ENCLOSURE II.

NOTE BY DR. K. C. ALHTA, M. SC., PH. D., ON THE SCHEME FOR CO-OPERATIVE INVESTIGATION BETWEEN THE PLANT PATHOLOGIST TO GOVERNMENT, BOMBAY AND THE MYCOLOGIST TO GOVERNMENT, CENTRAL PROVINCS ON THE PHYSIOLOGIC FORMS OF BLACK RUST FUNGUS OF WHEAT.

(1) A scheme for investigations on rusts of cereals in India is already in force under the auspices of the Imperial Council of Agricultural Research.

(2) As far as India is concerned even the life-history of the black rust of wheat is yet obscure and the problem is being investigated at Simla and Almora.

(3) It is premature therefore to conclude that barberry is definitely responsible for fresh out-breaks of black rust in India. In fact, work done during the last 8 years indicates that the factor of outstanding importance is the survival of medospores from season to season in the hills.

(4) In the absence of a definite proof of *Berberis* being an intermediate host for black rust of cereals in this country it is unsound to presume that there is a large number of physiologic forms of black rust that one has to deal with. Recent work in America has clearly shown that the ever increasing number of physiologic forms is due to hybridisation of different strains on *Berberis Vulgaris*.

(5) It may be mentioned here that *Berberis Vulgaris* is exceedingly rare over the greater part of the area under cultivation in the hills in India.

(6) I have recently had an opportunity of discussing the present position of the cereal rust problem in India with some of the foremost workers in the field including Professor Stakman, the discoverer of "physiologic forms" of black rust of cereals.

(7) It is my candid opinion that before rushing into a big scheme we have to make sure of the fundamental fact whether there is at all a large number of physiologic forms of black rust in our country. I am of the opinion that on account of the absence of *Berberis Vulgaris* over the greater part of the crop area in the hills it is very unlikely that we may have even half a dozen forms as against nearly 100 forms in U. S. A. In support of the above statement I would like to quote the case of Australia and Kenya where work on Physiologic forms has been recently done. Like India barberry is rare in both those areas and what do we find only 6 forms in Australia out of which only one is dominant and there are only 2 forms in Kenya.

(8) Another important fact to bear in mind is that in India there are two other rusts—on wheat and one on barley which demand the same amount of attention at our hands as they are even more destructive than black rust in several important areas under wheat and barley.

(9) As far as the scheme under report is concerned work on rusts without a laboratory in the hills is possible only for 2—3 months in the year and each year would mean a repetition of previous work because cultures can not be kept going during summer on the plains.

(10) The basic work on rusts in India has got to be done in the hills and there is no getting out of that because of the conditions of weather. Workers like Prof. Stakman, Dr. Newton, Dr. Butler, Sir Biffen and others are in complete agreement with me on this point.

(11) Work on physiologic forms of all the three rusts of wheat is badly needed in India and the problem being an all-India one, it is only right that work on different aspects be properly correlated in the interest of efficiency and economy. I for one cannot see the advantage of divorcing the scientific part of the investigations from the applied part because the former forms the basis for all measures of control.

(12) As a result of the discussion which I have recently had with Professor Stakman, I am going to start work of isolating collections of rust material from several places in the country with the object of making a preliminary study of physiologic forms of all the *three rusts*. Seeds of differential hosts are expected shortly from Messrs. Stakman, Mains and Hungerford, the three authorities on physiologic forms of black, brown and yellow rust respectively. The work will be done in the laboratories at Simla and Almora where cultures of rusts can be kept going all the year round.

(13) It is hoped that by April 1932 we will be able to get at the truth of the phenomenon, whether there are many physiologic forms under each of the three morphological species. By that time we also hope to know more about the life histories of black and brown rusts. A comprehensive scheme will then be prepared for work on all the three rusts and the co-operation of plant pathologists with provincial governments in the area of wheat cultivation would be indispensable.

(14) I am very glad to learn that besides myself there are workers interested in the cereal rusts problem in India and it would be a source of great pleasure and encouragement to me to seek their co-operation and to render them whatever help I can. When a more comprehensive scheme for different aspects of the problem is under preparation the plant pathologist of Bombay will be consulted along with others for the share of work each is willing to take up.

(15) Work on Cereal rusts and the breeding of resistant varieties is a large national scheme and cannot be undertaken without adequate equipment and laboratory facilities at suitable hill stations.

(16) For all practical measures the plant pathologists and plant breeders will have to work conjointly.

(17) I am sure that without preliminary study of the phenomenon of physiologic forms and until such time that we understand the life histories of the parasites concerned, isolated investigations on one single aspect of this huge problem will serve no useful purpose.

APPENDIX XIV.

APPLICATION FROM DR. S. S. BHATNAGAR FOR A GRANT OF
RS. 3,000 A YEAR FOR TWO YEARS TO STUDY THE EFFECT OF
IONS ON PLANT GROWTH.

Attention is invited to the attached application (Enclosure I) from Dr. S. S. Bhatnagar for a grant of Rs. 3,000 a year for two years to study the effect of ions on plant growth. The application has been approved by the Provincial Agricultural Research Committee (Enclosure II) and the Government of the Punjab, who are willing to provide the necessary facilities for Dr. Bhatnagar's work at Lahore. It was not received in time to be placed before the Advisory Board at its last meeting held at Simla in June 1930. In this connection, it may be mentioned that, in accordance with the recommendation made by the Advisory Board in response to memorandum No. 2135-Agri, dated the 3rd October 1930, the Governing Body has sanctioned for Dr. Bhatnagar an *interim grant* of Rs. 1,600 only without committing the Council to the larger scheme, which is now submitted for the consideration of the Advisory Board.

M. S. A. HYDARI,
Secretary.

The 26th November 1930.

ENCLOSURE I.

Copy of letter, dated the 30th January 1930, from Professor S. S. Bhatnagar, D.Sc., F.Inst.P., Director, University Chemical Laboratories, Lahore, to the Secretary, The Agricultural Research Council, Delhi, through the Vice-Chancellor, University of the Punjab, Lahore.

For the last two years we have been carrying on research work on the effect of ions on the growth of wheat and gram. This work suggested itself to us by the publication of the classical experiments performed at Rothamsted showing that broad beans are quite unable to flower or set seed if they are entirely deprived of boron, and that these and such other plants which are almost *in extremis* from lack of boron can be cured and started into healthy growth by the addition, to the soil, of a quantity of boric acid less than one in two and a half million parts.

We have obtained interesting results with wheat and gram crop grown in water cultures with regard to the catalytic effect of several ions. Silver ions have been found to make gram crop very resistant to excessive cold and frost and copper ions have helped in the preservation and subsequent maturing of wheat. Several other ions are discovered which though ordinarily toxic to certain plants proved growth promoting when applied in traces. These ions are thorium, zinc and barium for wheat and thorium, manganese and cobalt for gram. We wish to extend this work for wheat, gram and cotton in the midst of field conditions in the Punjab and I shall feel grateful to you if you could award me a grant of Rs. 3,000 a year for this work.

ENCLOSURE II.

Proceedings of the Special Committee appointed by the Provincial Council of Agricultural Research (Punjab), to make recommendations to the Council on applications for grants to the Imperial Council of Agricultural Research.

* * * * *

2 Dr. Bhatnagar applied for a grant of Rs. 3,000 a year for two years to study "*The Effect of Ions on Plant Growth*".

The investigation involves an extension of water culture experiments already initiated, to pot cultures and field work. The programme was discussed and approved.

It is proposed to spend the grant as follows :—

	Per annum.
	Rs.
Pay of one Research Chemist of several years' experience in research work on Rs. 200 per mensem	2,400
Pay of half-time Laboratory Assistant (<i>vide</i> application No. 1) on Rs. 25 per mensem	150
Travelling allowance under Fundamental Rules up to a maximum of	450
	<hr/>
	3,000
	<hr/>

The Committee decided to recommend the Provincial Council to ask the Imperial Council for this grant for two years.

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APPENDIX XV.

APPLICATION FROM DR. S. S. BHATNAGAR FOR A GRANT OF
RS. 4,150 A YEAR FOR TWO YEARS FOR INVESTIGATIONS ON
THE RELATION BETWEEN THE PHYSICO-CHEMICAL PRO-
PERTIES AND THE FERTILITY OF SOILS.

Attention is invited to the attached application (Enclosure I) from Dr. S. S. Bhatnagar for a grant of Rs. 3,000 for one year to conduct investigations on the relation between physico-chemical properties and the fertility of soils. The application has been revised (Enclosure II) by the Provincial Agricultural Research Committee and the Government of the Punjab, who are willing to provide facilities for Dr. Bhatnagar's work at Lahore. As revised, the amount of the grant applied for has been raised to Rs. 4,150 a year for two years. The application was not received in time to be placed before the Advisory Board at its last meeting held at Simla in June 1930. It is accordingly now submitted for the consideration of the Advisory Board.

S. A. HYDARI,

Secretary.

The 26th November 1930.

ENCLOSURE I.

Copy of letter No. 292/V.C., dated the 31st January 1930, from the Vice-Chancellor, University of the Punjab, Lahore, to the Secretary, Imperial Council of Agricultural Research, Delhi.

I have the honour to forward for favourable consideration two applications for assistance in research by Dr. Bhatnagar, University Professor of Physical Chemistry and Director of University Chemical Laboratories, Lahore. Dr. Bhatnagar is a researcher of very considerable ability, who has built up a school of chemical research in Lahore. He has been making a special point of bringing the research work done in his laboratories into connection with various problems of practical importance. I feel sure that any grant the Research Council is able to assign to him will be well spent and believe that it is quite likely to result in discoveries of economic importance.

Copy of letter, dated the 29th January 1930, from Professor S. S. Bhatnagar, D.Sc., F.Inst.P., Director, University Chemical Laboratories, Lahore, to the Secretary, Imperial Council of Agricultural Research, Delhi (through the Vice-Chancellor, University of the Punjab, Lahore).

I have the honour to request you to kindly allot me a grant of Rs. 3,000 for investigations on the relation between Physico-chemical properties and Fertility of Soils. My scheme of work will be as follows:—

The whole province will be divided into a number of climatic zones and representative soil samples will be taken from each area. The fertility value will be ascribed to each sample from a knowledge of the cropping history, ascertained from the actual farmers and other men on the spot and the Agricultural Department.

These samples will be subjected to a comprehensive physico-chemical analysis, and a correlation worked out between the laboratory data, and fertility value already known from actual growers of crops. This will not only give us a method of evaluating soil fertility in terms of easily determinable factors, but it will also afford valuable data regarding the question of enhancing the fertility of a particular soil. Attention will also be directed towards the question of evolving simple methods that could be used actually on the field with the minimum of equipment, for finding out soil fertility.

We have got sufficient laboratory equipment to cope with this work, but we are handicapped for want of adequate assistance to carry out the necessary routine work involved. One field man and an assistant will be required to enable me to take up the work and the above grant will be utilised to pay these assistants. The grant asked for is for one year, in the first instance.

ENCLOSURE II.

Proceedings of the Special Committee appointed by the Provincial Council of Agricultural Research (Punjab) to make recommendations to the Council on applications for grants to the Imperial Council of Agricultural Research.

Present :—D. Milne, Esq. (Director of Agriculture, Punjab) ; R. B. Jai Chund Luthra, Dr. P. E. Lander, Dr. S. S. Bhatnagar, Dr. J. N. Ray, Dr. H. B. Dunncliff, Convener (in the chair).

(1) Application of Dr. S. S. Bhatnagar for funds to conduct an investigation into the *Relation between Physico-chemical Properties and the Fertility of Soils.*

Dr. Bhatnagar explained his programme of research which in the opinion of the members, would cover about five years' work. The Committee discussed and accepted the problem and decided to recommend that the Imperial Council be requested to provide a sum of Rs. 4,150 a year for two years in the first instance. The question of renewal would be decided on the progress achieved. This sum would be used in the following way :—

	Rs.
(1) Pay of one research assistant (an M.Sc. in Chemistry or Post M.Sc. research chemist) at Rs. 150 per mensem	1,800
(2) Pay of one field man (a B.Sc. Ag. of the Agricultural College, Lyallpur), Rs. 100 per mensem ..	1,200
(3) Pay of one half-time Laboratory Assistant [<i>vide</i> application (2)], at Rs. 25 per mensem Rs. 12-8 ..	150
(4) Travelling allowance admissible under Fundamental Rules up to a maximum for the year of ..	1,000
	<hr/>
	4,150

The Laboratory work would be carried on in the University Laboratories at Lahore. Expenses for materials and contingencies would be borne by the University Laboratory and the Director of Agriculture would give, free of expense, all farm facilities.

The Committee unanimously recommend that the Provincial Council for Agricultural Research request the Imperial Council for Agricultural Research to grant a sum of Rs. 4,150 per annum for two years for this problem to be carried out under the (honorary) direction of Dr. S. S. Bhatnagar.

APPENDIX XVI.

SCHEME FOR THE APPOINTMENT OF A PHYSICAL ASSISTANT ON
THE STAFF OF THE AGRICULTURAL CHEMIST, BENGAL.

The attached scheme from the Government of Bengal for the appointment of a Physical Chemist on the staff of the Agricultural Chemist, Bengal, is submitted for the consideration of the Advisory Board. It will be noted that this scheme is in certain respects complementary to the scheme of research in soil chemistry for which the Council has already sanctioned a grant to Dacca University and that the proposed grant, if sanctioned, will enable the Agricultural Chemist, Bengal, to collaborate more effectively with the University Chemical Department.

The scheme involves a total expenditure of Rs. 22,568-8-0 (including Rs. 868-8-0 non-recurring) spread over a period of 5 years.

M. S. A. HYDARI,

Secretary.

APPOINTMENT OF A PHYSICAL ASSISTANT ON THE STAFF OF THE AGRICULTURAL CHEMIST, BENGAL.

Apart from routine, most investigations into soil problems have a general interest. - Keeping this in mind, it is interesting to note that, as far back as 1926, the Government of Bengal agreed that investigation into physical problems connected with soils is advisable, and sanctioned the appointment of a Physical Assistant on the staff of the Agricultural Chemist. Unfortunately funds have never yet been available to bring this appointment into being.

About the same time friendly co-operation between the Dacca University and the Department of Agriculture in Bengal, in joint investigation of problems of agricultural interest, commenced, and the scheme under which the University is to receive grants for research into problems of a physical nature connected with soil, also into the factors connected with the nutrition of paddy, is a direct result of this collaboration.

As arranged and sanctioned by the Governing Body of the Imperial Council of Agricultural Research, the Dacca University is to take up the investigations in question, but at various stages in the investigation it will be of critical importance to discuss the practical bearing of any results which may be obtained, and to put such results to a field test. There can be no doubt as to the value of such an arrangement which will ensure that any results obtained in the laboratory will be assayed on a field scale, without any unnecessary delay.

Mr. Carbery, the Agricultural Chemist, has already more work than it is possible for him to do, and, without extra help, it is impossible to keep up more than a semblance of the collaboration, between the laboratory and the field, which is so important in investigations of this kind. Moreover, the Advisory Board of the Imperial Council of Agricultural Research has recently recommended a scheme for investigation of soil colloids by the Calcutta University, and it is hoped that the Department of Agriculture may be able to collaborate with the Calcutta University in the same way as with the Dacca University. It is necessary to add that neither University has the land, or the trained staff, to carry out such practical field tests on their own, and it is because of this that the appointment asked for is likely to be of such value.

In addition to the above, the Agricultural Chemist in Bengal has a comprehensive programme for physical and chemical research into soils, the results of which would certainly be of general interest. The programme includes:—

- (1) Soil moisture, the means by which it is retained by different soils, and the respective capacities of the latter to deliver soil moisture to plant growth. Maximum capacity of retention.
- (2) How the retentive capacity of the various types is affected by soil temperature at various times of the year.
- (3) The relation between soil moisture and the plant as influenced by (a) addition of soluble fertilisers, and (b) addition of lime when necessary.
- (4) The influence of the more common crops on moisture content, and the minimum moisture content required to produce a normal yield.
- (5) Rate of evaporation.
- (6) Incidence of rainfall and its effect.
- (7) Capillary action.

These investigations have not only a direct relation to the productivity of crops but to the cost of production. On irrigated land a knowledge of the moisture capacity of the soil will not only enable the cultivator to reap a maximum crop but ensure him against spending money on excessive irrigation.

As the post is temporary, the pay of the assistant to be entertained will be Rs 250 per mensem, and the following expenditure will be required :—

Recurring expenditure.

	1st Year.	2nd Year.	3rd Year.	4th Year.	5th Year.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Pay of assistant at Rs. 250 per month.	3,000	3,000	3,000	3,000	3,000	15,000
Laboratory servant at Rs. 20 per month.	240	240	240	240	240	1,200
Chemical and apparatus	500	500	500	500	500	2,500
Travelling allowance	600	600	600	600	600	3,000
Total ..	4,340	4,340	4,340	4,340	4,340	21,700

i.e., Rs. 4,340 each year for five years.

It is understood that all ordinary apparatus, such as flasks, etc., will be available from the main laboratory stock and will not be charged to the Research Council. Only new apparatus of a special nature will be so charged.

It is also understood that the Bengal Department of Agriculture will provide facilities for all field experiments which may be necessary.

Non-recurring expenditure.

Special apparatus outside ordinary laboratory equipment, which will be necessary for such work as per detailed list below :—

	Rs. A.
Apparatus for thorough mixing or sampling of soil in bulk	120 0
Constant volume bottle (Haines) for measuring soil shrinkage	12 8
Collin's Calcimeter for estimation of Carbonates in soils ..	90 0
Boxwood slide rule for above	9 0
Pipette with two way top (3)*	31 0
Graduated jar (1,000 c.c.) (3)*	28 0
India-rubber cork to fit above (3)*	9 0
Sieves for mechanical analysis of soils (8 cm. diam. by 4 cm. deep), No. 70, Institute of Mining and Metallurgy, suitable for the international standard 0.2 mm. (12)	153 0
Ditto with 2 mm. diam. perforation (6)	45 0
Brass box with perforated loose bottom to take a filter paper 2 inch. diam., to estimate moisture holding capacity, swelling capacity, etc., of soils (6)	45 0

* For use in the apparatus (already available) for the mechanical analysis of soil by the new official method.

	Rs. A.
Silica dishes (12 × 50 mm.) (24) for moisture determination	60 0
Aluminium covers for above (24)	21 0
Soil Auger with sleeves for use in dry soils	70 0
Extension for use with above	20 0
Balance (dial type) weighs up to 24 lbs. in 1 oz. divisions	13 0
"Ditto" weighs	10 0
Aluminium boxes (numbered) for moisture determination with caps, No. 1—24 (No. A)	30 0
Soil acidity tester (Trong) for determining lime requirements in the field (complete set)	30 0
Extra parts for above	32 0
Capillary tubes (graduated) (3)	40 0
Total ..	508 8

Total charges are estimated as follows :—

	Rs. A.
Recurring (Rs. 4,340 each year for 5 years) ..	21,700 0
Non-recurring (cost of apparatus and equipment) ..	868 8
Total ..	22,568 8

R. S. PINLOW,
Director of Agriculture, Bengal.

Dacca,
The 6th August, 1930.

ANNEXURE.

Estimated items of expenditure from the grant of Rs. 5,000 applied herewith.

				Rs. A. P.		
1. Sample of 300 maunds of barley at Rs. 4½/- per maund	1,350	0 0
2. Packing	120	0 0
3. Loading and other handling charges at -½/- per bag	9	6 0
4. Railway freight to Karachi at -½/- per maund	225	0 0
5. Unloading and other charges at -¼/- per maund	37	8 0
6. Steamer freight to London (estimated)	250	0 0
7. Unloading and other expenses in London	37	8 0
8. Other charges, commission, wharfage, customs, etc.	150	0 0
9. Barley Survey—Cost of arranging the collection, pay of staff and travelling expenses, etc.	2,000	0 0
10. Manurial experiments	750	0 0
11. Rounding	70	10 0
					<hr/>	<hr/>
					5,000	0 0

EXTRACTS FROM THE MINUTES OF THE 2ND MEETING OF THE
UNITED PROVINCES AGRICULTURAL RESEARCH COMMITTEE
HELD ON JUNE THE 2ND, 1930.

III. The Committee considered an application from the Department of Agriculture, United Provinces, for a grant of Rs. 5,000 annually for 3 years for experiments in marketing new types of barley.

The application was discussed and approved and the following resolution was passed by the Committee.

"The Committee agrees to recommend to the Imperial Council of Agricultural Research, the application of the Department of Agriculture, United Provinces, for a grant of Rs. 15,000 spread over a period of 3 years for experiments on manure and marketing in new types of barley."

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APPENDIX XVIII.

The attached application from the Government of Bengal (Enclosure I) for a grant totalling Rs 50,721 over a period of five years to meet the cost of a Physiological Chemist and staff to study animal nutrition problems in Bengal is submitted to the Advisory Board for consideration.

2. The Animal Husbandry Expert to the Council while supporting this scheme has outlined a general scheme (Enclosure II) for the employment of a similar special staff in every major province which is not at present provided with any animal nutrition research staff. It is suggested that the Bengal scheme may be considered along with, and as forming part of this general scheme.

M. S. A. HYDARI,

Secretary.

5th December 1930.

ENCLOSURE I.

Letter from the Secretary to the Government of Bengal, Agriculture and Industries Department, to the Secretary, Imperial Council of Agricultural Research, No. 5131, dated the 13th November 1930.

With reference to your letter No. 1817-Genl., dated the 17th September 1930, I am directed to forward, for consideration at the meeting of the Advisory Board to be held in January 1931, a scheme for the appointment of a Physiological Chemist to study animal nutrition problems as approved at the second meeting of the Bengal Agricultural Research Committee held on the 7th instant and to say that the Government of Bengal (Ministry of Agriculture) recommend the scheme subject to the condition that no financial liability will devolve on this Government.

2.

The proposals submitted by the Live Stock Expert, Bengal, for a Nutrition Section at Dacca were submitted to me for advice, I consider the scheme sound and workable, and it is also my opinion that the work proposed is of a practical nature and most essential.

Bengal is peculiarly situated as regards animal nutrition problems, as, besides the Burdwan Division in Western Bengal where climatic conditions resemble those of much of Peninsular India. It includes East Bengal where a moist climate with comparatively even temperature is, with adjacent Assam unique in India.

Investigations into the factors causing the lack of physique in Cattle in North East India is in itself a most important work. The difficulties may or may not be partly climatic but there are indications that they are at least partly nutritional. It is obvious that careful study of such difficulties will not only help Bengal but that results, when obtained, will be of value in solving general problems of animal nutrition.

It is proposed that the work at Dacca should be carried out in close collaboration with me, and I welcome such an opportunity of getting into touch with problems of the utmost importance, which are vital not only to North East India but to India as a whole.

(Sd.) F. J. WARTHE.

ENCLOSURE I.

Proposal for the appointment of a Physiological Chemist to study animal nutrition problems.

For a number of years the Agricultural Department has been carrying out crop experiments with both indigenous and imported fodder crops. The critical tests so far have been yield per acre and palatability gauged by the refusal or otherwise of the stock to accept the fodder placed before them or otherwise.

Owing to lack of staff, it has not been possible to attempt the estimation of nutrition values. Yet a crop giving a high yield of green weight per acre may not be so valuable commercially as one giving a lesser outturn, if the feeding value of the latter is higher.

The appointment of a Physiological Chemist is necessary to complete the investigations begun and described above.

It is proposed that the work while directly controlled by the Agricultural Chemist, Bengal, should be generally supervised and directed by the Imperial Physiological Chemist.

Bengal offers opportunities for the study of problems in animal nutrition which are denied to other provinces. In certain areas the rainfall is as high as 200 in., whilst in others the maximum is only 50 in. The climate varies from almost arid conditions where a rainfall of 50 in. is practically confined to the monsoon months, to humid conditions unique, except in Assam, where rainfall is appreciable in ten months of the year. Soil over a considerable tract contains a sufficiency of lime, in others there is a deficiency of lime. Similarly there are areas showing a sufficiency of phosphates and potash, and others where these are deficient. Results obtained in Bengal would thus widen the basis on which general conclusions regarding nutrition can be arrived at.

The feeding of minerals to stock has been conducted in Bengal on a scale only limited by the staff available. Results have been estimated on the general health of the animals, no detailed investigation being possible. Generally speaking the addition of lime to the diet has shown little or no improvement.

Feeding of bonem meal has certainly improved the appearance of the stock, whilst diminution in the incidence of pneumonia in the young stock at Rangpur, and katts at Dacca, seems to be definitely connected with the inclusion of iodine in the ration. These observations follow generally those made in other countries and might be expected in a rain-washed tract like that in question. At the same time it has been pointed out by physiological chemists that results obtained for a particular area should not be generally applied without previous experiment. The effects of such blind application may be neutral, or even deleterious.

The Department can offer facilities for—

(1) Laboratory Accommodation at Dacca.

(2) Experiments on stock—

(a) At Rangpur in North Bengal.

(b) At Dacca in East Bengal.

(c) At Chinsura in West Bengal.

(d) At Berhampore in Central Bengal.

These farms are in different belts with a wide difference in soil, climate and rainfall.

(3) Cultivation of fodder crops on twenty farms in the Pre-idency so that the nutrition value can be estimated in the laboratory and eventually on stock.

The scheme has been drawn up in consultation with the Imperial Physiological Chemist and the estimated expenditure over a period of five years, of which details are attached is as follows :—

					Rs.
Non-recurring	..	..	..	..	2,131
Recurring	..	..	..	..	48,590

As the scheme is of undoubted importance and interest to India generally as well as to Bengal, it is hoped that the Imperial Council of Agricultural Research will provide funds.

The Department of Agriculture, Bengal, will bear all charges connected with feeding of stock, and with casual labour.

Detailed expenditure for staff, total non-recurring and recurring expenditure, for the full scheme is given below :—

			Rs.
Total non-recurring expenditure (as per list attached)	..		2,131
Total recurring expenditure for a period of five years	..		48,590
Total required for the complete scheme	..		50,721

Detailed expenditure for staff and total of recurring expenditure.

	1st year.	2nd year.	3rd year.	4th year.	5th year.
	Rs.	Rs.	Rs.	Rs.	Rs.
Chemist	3,000	3,000	4,200	4,800	5,100
Assistant Chemist	1,020	2,160	2,100	2,000	2,880
1 Clerk	300	300	420	420	450
1 Fieldman	360	360	420	420	450
Frons	312	312	312	312	312
Contingencies	770	770	770	770	770
Travelling allowance*	1,000	1,000	1,000	1,000	1,000
House rent†	210	210	210	210	210
	7,002	8,802	9,702	10,502	11,602
Grand total for five years ..			48,590		

Explanations.

*The Chemist and a Fieldman will have to tour in the Province, visiting different farms.

†There is no accommodation for officers on the Dacca Farm. An allowance is granted to officers drawing below Rs. 100 per mensem.

List A.—Non-recurring expenditure—Apparatus.

	Rs.	A.
Small oven	150	0
One set of Kilogramme weights from 100 gr. to 10 kgs. ..	25	0
2 Weight boxes (small)	15	0
2 Grinding mills	500	0
	<hr/>	<hr/>
	690	0

List B.—Non-recurring expenditure—Nutrition stall equipment.

	Rs.	A.
2 Almirahs	100	0
2 Ration cupboards	100	0
1 Beam balance	30	0
Table balance for weighing concentrates	50	0
6 Lanterns	15	0
Wash basins for sampling faeces	6	0
12 Enamelled plates	7	8
40 Urine bags at Rs. 6 each	240	0
40 Rubber corks	40	0
36 Clips	20	0
1 Ice chest	100	0
24 Enamelled buckets	100	0
24 Bottles with stoppers, 5 litre	140	0
24 Enamelled mugs (12 big and 12 small)	16	0
12 Enamelled funnels	9	0
12 Chamber pots	18	0
Office furniture, typewriter	350	0
	<hr/>	<hr/>
Total non-recurring expenditure	2,131	8

*Recurring expenditure.**(Touring.)**Staff—*

- 1 Chemist on Rs. 250 to Rs. 750.
- 1 Assistant Chemist on Rs. 160 to Rs. 300.
- 1 Clerk on Rs. 30 to Rs. 50.
- 1 Byre Overseer on Rs. 30 to Rs. 50.
- 2 Peons on Rs. 13 to Rs. 15.

*For details, see attached statement.

Chemicals (recurring).

			Rs.	A.
Sulphuric acid free from nitrogen, 100 lbs.	..	..	100	0
Sodium hydroxide, 100 lbs.	..	..	50	0
Sodium sulphate (anhydrous), 30 lbs.	..	..	30	0
Copper sulphate, 10 lbs.	..	..	12	0

Details of contingencies (recurring).

(Apparatus and chemicals as per attached list.)

			Rs.	A.
Upkeep and replacement of apparatus	..	..	100	0
Ordinary chemicals	..	..	200	0
Upkeep on stalls, etc.	..	..	200	0
Office and miscellaneous	..	..	78	0
Total	..	..	770	0

ENCLOSURE II.

Note by the Animal Husbandry Expert to the Imperial Council of Agricultural Research.

I am in full agreement with the proposal put up by the Live Stock Expert, Bengal, for a Physiological Chemist and I consider that similar appointments should be made in every major province of India which is not at present provided with any animal nutrition research staff.

The Royal Commission on Agriculture in India points out that in western countries, in order to make the best use of their cattle, the study of nutritional problems is now being dealt with at numerous institutions, and that no one institution can hope to deal successfully with so wide a range of problems as now await solution in India.

They recommend that a combined attack on animal nutrition problems should be planned, and in my view the best and most economical method of attack would be to arrange for an animal nutrition section in every major province, to work in close touch with the proposed enlarged nutrition institute at Dehra Dun, and in collaboration with the Live Stock Experts and Directors of Veterinary Services of Provinces. The amount of work to be done is so enormous that without some such organisation it will be impossible to make satisfactory progress with the study of locally grown forage crops within a reasonable period.

Moreover, apart from the great practical benefit to be derived from a systematic study of the feeding values of the various forage crops produced, Physiological Chemists are required to collaborate with Provincial Veterinary Investigating Staffs in the study of local disease conditions.

Though little exact information is available many of these are known to be associated with nutritional deficiencies, in the forage grown under the very varying conditions of soil and climate met with in different parts of India.

In countries where fuller use has been made of veterinary and chemical science in the study of disease, it has been found necessary to provide for such collaboration, and I consider that this Council would be rendering a great service to the Live-Stock Industry of India by assisting provinces to study their nutritional problems.

It is no doubt desirable that Provinces should bear a substantial portion of the cost of such provision, and in any case they should provide the necessary accommodation, but in view of the existing financial stringency I consider that the Council would be justified in undertaking to bear the entire cost of the proposed staff and equipment in such cases, for 5 years, provided that the Government concerned would undertake to find the necessary buildings and accommodation.

The position in Bengal is not very different from that in other provinces and I would strongly recommend that the Council should consider the desirability of offering similar assistance to such major provinces and States as desire assistance so that the combined attack recommended by the Royal Commission may be instituted simultaneously all over India.

The cost per province would be roughly Rs. 10,144 per annum, while the benefit to the Live-Stock Industry should be enormous.

Without such an organization, progress in nutrition research must be very slow, and it will be a long time before it will be possible to provide the exact information required, in order that the best use may be made of the forage obtainable.

The staff and equipment asked for in this case appears to be reasonable and might serve as a basis for other provinces similarly placed.

Sd. A. OLIVER, Col.

APPENDIX XIX.

APPLICATION FROM DR. H. C. CHAUDHURI FOR A GRANT OF
Rs. 12,600 SPREAD OVER 3 YEARS FOR INVESTIGATION OF THE
"WITHER TIP" OF THE CITRUS TREE.

Attention is invited to the attached application (Enclosure I) from Dr. H. C. Chaudhuri for a grant of Rs. 8,000 a year for 5 years to complete his work on the "wither tip" of the citrus tree. The application has been revised (Enclosure II) by the Provincial Agricultural Research Committee and the Government of the Punjab. As revised, the grant for the scheme has been reduced to Rs. 12,600 spread over 3 years. The necessary facilities for carrying out field work and the apparatus, etc., required, will be provided by the Local Government. The application was not received in time to be placed before the Advisory Board at its last meeting held at Simla in June 1930. It is accordingly now submitted for the consideration of the Advisory Board.

M. S. A. HYDARI,

Secretary.

The 26th November 1930.

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ENCLOSURE I.

From Dr H. Chaudhuri, Reader in Botany, Punjab University, Lahore, to the Secretary, Imperial Council, Agricultural Research, New Delhi, dated Lahore, the 13th November 1929.

The Director of Agriculture, Punjab, in his letter No. 63/72-229, dated Lahore, the 12th March 1929, to the Dean of University Instruction, Punjab University, suggested a number of agricultural problems for the province and enquired how far we in the University could help the Agricultural Department in solving its problems. He also enquired about the facilities and expenses to be incurred by the Department if we took up the work. In my letter to the Dean, dated Lahore, the 21st March 1929, a copy of which is enclosed, I pointed out the facilities for Mycological work in my laboratory and mentioned the agricultural problems which we could take up and the costs to be involved.

We have a well-equipped Plant Pathology laboratory and the M. Sc. students in this University are granted degrees on the results of this research work. Hence, every year, we are training students in Plant Pathology. Botany students of the Honours School have to go through a compulsory course of Plant Pathology extending over one year. This is no where so in any other Indian Universities.

Some of our students are holding appointments as Mycologists in different provinces.

Though we are doing our best to give them as complete possible a training, we find we cannot train them properly in field experimental work and control of diseases under field conditions. For lack of funds our work has necessarily been confined almost within the walls of the Laboratory. If we are to make our knowledge and research of this branch to be of benefit to the agriculture of this province, it is essential we must have opportunities for field control and experimental work. Though I worked out a very modest scheme for the Agricultural Department, they have not yet been able, in spite of their good intentions, to come forward with the help, apparently for want of funds. From the enclosed copy of letter, you will find that I asked for Rs. 4,000, recurring for 3 years and Rs. 1,500 non-recurring for equipment of the field laboratory. Till the local Government is able to provide us with an experimental farm, I propose to have on rent the use of a private farm near about Lahore for experimental purposes and to buy certain apparatus, *e.g.*, spraying machines, dusting apparatus, fumigators, etc. Menial staff will also have to be appointed. This will mean an additional Rs. 2,500 per annum. Also the provision of a whole-time research scholar besides the research assistant on Rs. 1,200 per annum, will work the scheme of Rs. 8,000 (eight thousand) per annum. Considering the facility we have here, and the amount of very useful work we will be able to produce, if this help is provided. I hope the Imperial Agricultural Council will kindly sanction us a recurring grant of Rs. 8,000 for at least 5 years as an experimental measure. I feel confident about the successful work we will be able to produce to help the Agricultural Department in solving its problems. Hoping to hear from you soon.

Copy of a letter from Dr. H. Chaudhuri, Reader in Botany, Punjab University, to the Dean of University Instruction, Punjab University, dated Lahore, the 21st March 1929.

The letter of the Director of Agriculture, No. 63/72-229, dated Lahore, 12th March 1929, to the Dean of University Instruction, Punjab University, which was sent round to the University Professors, was shown to me. I note that the

Agricultural Department is willing to work in co-operation with the University and Government Educational Departments. This will certainly be a move in the right direction. Two years back in a letter to the Director of Agriculture, Punjab Government, I drew his attention to the fact that we had a very well-equipped laboratory for Mycological and plant Bacteriological work and that if his department co-operated with us, we could help the Government in combating many of the fungal and bacterial pests of the Punjab plants. Along with my letter I forwarded a scheme showing how it could be worked out very economically.

Most of the problems mentioned in his letter, under the group Mycology and many more, also 9 and 10 from the section of Agricultural Botany, No. 2 from Chemical and Nos. 1 and 2 from Zoological Section could very well and conveniently be investigated in our laboratory. Our Mycological laboratory is certainly much better equipped than many of the Government Mycological laboratories in the provinces in India.

Investigations on the green-ear disease of Bajra (Problem 7a, Mycology) have been carried on for the last three years, and a short note has already been published. The work is nearing completion.

The citrus wither tip and Heart rot of citrus (7b, Mycology) are now being investigated by one of our post-graduate students, who will submit his result as a thesis for the M. Sc. degree next month.

Histological and pathological studies of fungi (3, Mycology) have been always carried on and worked out by our students. A paper on a disease of cotton (A study on the biological and cultural character of *Capnodium* on Cotton) submitted as a thesis for the M. Sc. has already been published.

Collection and identification of fungi (4, Mycology) are being carried on slowly.

Not only is the study of soil fungi being made in the laboratory (1, Mycology) but also that of soil protozoa (1, Zoology), most members of which come under the groups ciliates and flagellates of the algal flora. The writer of this note when in Europe last year worked specially on soil protozoa and bacteria from different Indian soil samples. A preliminary report has already been published and the complete paper will soon be published in the Journal of Protistology. (This has since been published in the *Annales de Protistologie*, Vol. II, Fasc. 1, 15, April 1929). The writer had the opportunity of studying soil bacteria with Wnoogradsky at the Pasteur Institute and discussing the problem and his paper on Indian Soil Protozoa with Culter and Sanden at Rothamsted. The laboratory here is fully equipped for soil micro biology work.

The greatest handicap in all our efforts to be of service to the agriculture of the province has been our isolated existence. If our knowledge of this branch of the applied science is to be of real benefit to the province, it is imperative that we must have facility for carrying on extensive field work. I would like the student who is working on the wither tip disease of Citrus to visit different affected areas, study environmental conditions, etc., and carry on inoculation experiments in the field.

If the Agricultural Department will co-operate with us in the University, I am sure, we will be able to help the Department in solving many of its problems. We need more of co-operation in combating the pests. Incidence of any disease anywhere in the Province should at once be reported to us. I now give below the items of expenditure which I think the Department will have to incur to start with:—

- (1) An experimental farm near about Lahore with a small field laboratory. The equipment of the field laboratory should not cost more than Rs. 1,500 to start with.
- (2) Provision for travelling allowances to inspect, collect materials and experiment locally. Rs. 1,000 per annum till No. 1 matures when this amount will necessarily be reduced.

- (3) Appointment of a Research Assistant, Rs. 150—25—200 per month for 3 years for the present.
- (4) Part-time office clerk with knowledge of typewriting (Rs. 30) and a whole-time bearer (Rs. 20).
- (5) Contingency grant (to include expenses for photography and all minor expenses), Rs. 600 per annum.

The work may be commenced with effect from the beginning of the next financial year if the Director will agree to meet the above extra expenditure of about Rs. 4,000 (rupees four thousand per annum). If this scheme is given effect to for three years in the first instance as an experimental measure, I am confident the Director will never regret his decision.

ENCLOSURE II.

Proceedings of the meeting of the Sub-Committee appointed by the Punjab Agricultural Research Council to consider Dr. Chaudhuri's scheme, held in the Biological Laboratory of the Government College, at 9-30 a.m., on the 2nd May 1930.

PRESENT :

Dr. H. Chaudhuri,

Rai Sahib Prof. Jai Chand Luthra.

Dr. K. R. Mohindra.

Prof. D. P. Johnston.

Prof. S. N. Kishyap, Convener (in the chair).

1. It was agreed that the "wither tip" of the Citrus tree proposed by Dr. H. Chaudhuri for investigation is an important and desirable problem for investigation and he may take it up. The study should include the life-history of the casual organism, if any, and other factors concerned, and the measures of control. The Committee finds that the problem has already been under investigation under the guidance of Dr. Chaudhuri but a great deal of further work is necessary to complete it.

2. The requirements for the investigation are given below :—

(a) A Research Assistant on Rs. 150—25—200 for three years.

(b) A Laboratory and Field Attendant on Rs. 25 for 3 years.

(c) Travelling allowance up to a maximum of Rs. 1,000 per year.

(d) Contingent grant of Rs. 600 per year.

(e) Initial equipment—non-recurring Rs. 600.

Details of the expenditure for the 3 years :—

				Rs.
I year—Research Assistant	..	..	..	1,800
Attendant	..	..	..	300
T. A.	..	..	..	1,000
Contingencies	..	..	..	600
Initial equipment	..	..	..	600
				<hr/>
				4,300
				<hr/>
II year—Research Assistant	..	..	..	2,100
Attendant	..	..	..	300
T. A.	..	..	..	1,000
Contingencies	..	..	..	600
				<hr/>
				4,000
				<hr/>

				Rs.
III year—Research Assistant	..	..	..	2,400
Attendant	..	..	..	300
T. A.	..	..	..	1,000
Contingencies	..	..	..	600
				<hr/> 4,300 <hr/>

3. It is understood that the Agriculture Department would provide the necessary facilities for carrying out field work.

4. It is understood that the apparatus, etc., in the University and Government College laboratories would be at the disposal of Dr. Chaudhuri in connection with this work.

SIV NARAIN KASHYAP,
(Convener).

LAHORE,
The 3rd May 1930.

APPENDIX XX.

ESTABLISHMENT OF A RESEARCH STATION AT SHILLONG FOR THE
DEVELOPMENT OF BEE-KEEPING IN INDIA.

Attention is invited to the letter (copy attached) from the Director, Imperial Institute of Agricultural Research, Pusa, No. 5372, dated the 14th August, 1930, regarding the establishment of a research station at Shillong for the development of Bee-keeping in India. The scheme, which is for 3 years in the first instance and is fully explained in the application forwarded by the Director, Pusa, involves an expenditure of Rs. 7,100 non-recurring and Rs. 90,000 recurring over a period of three years (Total Rs. 97,100).

M. S. A. HYDARI,

Secretary.

30th September 1930.

LETTER FROM DR. W. H. HARRISON, D.Sc., OFFICIATING DIRECTOR, IMPERIAL INSTITUTE OF AGRICULTURAL RESEARCH, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 5372, DATED PUSA, THE 14TH AUGUST 1930.

SUBJECT :—*Scheme for the development of Bee-keeping in India.*

As directed by the Government of India in their Education, Health and Lands Department letter No. 1589-Agr., dated 31st July 1930 (copy enclosed for ready reference), I have the honour to forward herewith a scheme drawn up by Mr. T. Bainbrigge Fletcher, Imperial Entomologist, Imperial Institute of Agricultural Research, Pusa, for the development of bee-keeping in India by the establishment of a research station at Shillong and to request that the sanction of the Imperial Council of Agricultural Research may kindly be obtained to the allotment of a grant to finance the scheme.

LETTER FROM MR. M. I RAHIM, I.C.S., UNDER SECRETARY TO THE GOVERNMENT OF INDIA, DEPARTMENT OF EDUCATION, HEALTH AND LANDS, TO THE DIRECTOR, IMPERIAL INSTITUTE OF AGRICULTURAL RESEARCH, PUSA, No. 1589-AGRI, DATED SIMLA, THE 31ST JULY 1930.

SUBJECT :—*Scheme for the development of Bee-keeping in India.*

With reference to your letter No. 2780, dated the 26th April 1930, I am directed to say that the Government of India approve of the scheme drawn up by Mr. Bainbrigge Fletcher, Imperial Entomologist, for the development of bee-keeping in India by the establishment of a station at Shillong, and to request that in accordance with the prescribed procedure the scheme may be submitted officially to the Imperial Council of Agricultural Research with an application for a grant to finance it.

SCHEME FOR THE DEVELOPMENT OF BEE-KEEPING IN INDIA.

There is a practically unlimited demand for Honey in India, where Honey-bees occur wild almost everywhere ; yet the supply of honey is nowhere in excess of the demand which is largely met, in the case of towns at any rate by imports from Australia, America and Europe. There seems to be no reason why India should not supply a considerable proportion of her own requirements in this line and make a valuable addition to the diet of the people.

2. Three species of wild Honey-bees occur commonly, practically throughout India. The Rock-Bee (*Apis dorsata*) is a large Bee which builds a large single comb on rocks and tall trees, often in regular colonies ; it is fierce and intractable and its habits of building a single exposed comb and of seasonal migration make it unsuitable for domestication. The Little Bee (*Apis florea*) also makes a small single exposed comb, usually in a bush, and its habits and small production also render it unsuitable for domestication. The Indian Bee (*Apis indica*) makes several parallel combs which are, under natural conditions, placed in a hollow tree ; this habit makes it suitable for domestication, which is carried out in some parts of India ; chiefly in the Hills. The chief defect of the Indian Bee is its small production of honey, due to the fact that in the plains it is active throughout the whole year and has therefore not found it necessary to lay up large stores to tide it over the winter. At Pusa we have found that an average honey production per colony of the Indian Bee is about 6 lbs. wt. In the Hills of Northern India, where there is a more pronounced winter, the honey-storage is larger and may be put at 30-40 lbs. wt. But even these latter figures are small in comparison with those of the European Honey-bee and, if a Bee of larger storage-capacity could be used, there seems to be no reason why much better results should not be obtainable in India.

3. We have already experimented at Pusa with European Bees (*Apis mellifera*) which gave good results as long as the imported queens lived, but we found it impossible to carry them on at Pusa, mainly because all the young queens which were reared were killed off by predaceous enemies.

4. I consider that there is very considerable demand in India for putting Apiculture on a proper footing. My correspondence includes constant requests from all over India and Burma for information about Bee-keeping, and there is ample scope for a whole-time Apiculturist to advise and help Indian Bee-keepers in regard to improved methods of Apiculture and in particular to supply colonies, Hives and apparatus, the want of these being at present a decided obstacle to advance. Whilst the Hill Districts offer the best chances of success, the Plains also, in most localities, allow of Bee-keeping on a small scale. Our difficulties at Pusa were mainly in connection with the breeding of imported Bees; there is no difficulty in keeping the local bee (*Apis indica*) on a small scale. Few places offer facilities for Bee-keeping as a whole-time source of income, but there are few which will not allow of Bee-keeping on a small scale as a subsidiary source of income. There is a very large production of honey (and wax) in India but the production at present cannot meet the demand, mostly because of the crude methods of collection of honey, and also because the production of the local bees is small. Experimental work in a suitable locality by a whole-time Bee Expert is therefore necessary to determine whether we can get a better-yielding type of bee in India and also to improve local methods of Bee-keeping. Such experiments should deal with :—

- (1) The manipulation of the Indian Bee, including hive-design and trials with various local races,
- (2) experiments with imported bees, especially Italian and Egyptian races,
- (3) attempts to cross Indian and imported Bees to endeavour to secure a strain of higher honey-yielding capacity.

These experiments, if successful, will be of general benefit to India.

5. To do this, we require the services of a whole-time Bee Expert, thoroughly familiar with the art of Bee-keeping and with the characteristics of the different races of Honey-bees, and specially with practical experience of the technique of artificial crossing of Bees. Such an expert cannot be secured in India nor will it be an easy matter to secure the right type of man from outside. Inquiries from (1) the British Bee-keepers' Association, England, (2) the Apicultural Section of the Bureau of Entomology, Washington, and perhaps also from the Chief Entomologists in South Africa and Australia, will have to be made as to the possibility of securing a suitable candidate. I do not think that a suitable man will be willing to come for less than a consolidated pay of Rs. 1,500 per annum. He will have to be engaged on a short-term agreement.

6. In order to enable the experiments to yield definite results, it is necessary that they should be conducted for at least 5 years, but I think that we should be in a position to close down after 3 years if the results are not promising or to continue for a couple of years longer if required. I consider, therefore, that the Scheme should be conducted for three years to commence with.

7. As regards locality, a place is required which is suitable climatically (not too hot in summer for imported bees and not too cold in winter for Indian Bees from the plains) and with sufficient bee-pasturage and lack of predaceous enemies.

*Since this note was prepared, I have heard from a Mr. Baldry, at Mahaneshwar, who claims to be a Bee-keeping Expert and who is apparently desirous of employment as such.

I have examined the possibilities of Shillong and Dehra Dun with reference to these requirements and find that the former is more suitable than the latter for the following reasons :—

- (1) the bee-pasturage at Dehra Dun seems inferior to that at Shillong and to be already fully occupied—probably overstocked with bees, so that any Agricultural Experiment Station, bringing in a new lot of bees, will have to face severe competition in gathering nectar and pollen. It may be noted here that a strong bee-colony will consist of roughly 20,000 worker-bees, which number may be raised to 50,000 during a good period of honeyflow, so that an apiary of even ten or twenty hives will require several millions of flower daily. The local flora of Shillong is unusually rich and should support an experimental apiary without difficulty. The local flower and fruit gardens and the numerous wild flowers provide rich stores for bees to draw upon. Shillong has also the unique advantage of having at present only one species of honey-bee (*Apis indica*).
- (2) Bee-eaters are certainly present at Dehra Dun, but are apparently absent from Shillong. Amongst enemies of bees, although not strictly predators, are the Wax Moths which lay their eggs in combs, especially of weak colonies, the larvae tunnelling in the wax and in bad cases, leading to the abandonment of the nest. Of these Wax Moths, we have two species in India, *Galleria mellonella* and *Meliphora griseola*. Both occur commonly in Dehra Dun. We have no record of either at Shillong, but both are likely to occur, being practically cosmopolitan insects. Neither, however, should be allowed to obtain a footing in a well-kept apiary although they may be serious pests of badly-kept hives and of colonies of Wild Bees.
- (3) There is a local bee-keeping industry at Shillong, but not at Dehra Dun.

8. With regard to subordinate staff, one Assistant on Rs. 200 per mensem will, in my opinion, be sufficient in the beginning. I do not think it necessary to have a Class II Assistant to commence with. If the scheme proves unlikely to yield results the pay of such a man would be wasted. If the scheme is successful and it seems desirable to carry it on, there will be ample time (about the third year) to consider taking on a Class II man if such is required. I doubt whether, in most cases, there is any great advantage in starting a new man in Class II, anyway : I should be inclined to start a new man in the ordinary Assistant Grade with prospect of rapid advancement to Class II if worthy.

9. As regards land and buildings one or two acres of land and a few temporary sheds will be sufficient to meet the requirements. There is a large fruit garden (about 100 acres) at Shillong belonging to Government and leased to Mr. C. H. Holder. The United States Entomological Bureau had their temporary station for *Popillia* work in this Fruit Garden and I think it would be possible to arrange with Mr. Holder to place the Bee Station there. If not, it could be put just outside the Fruit Garden. In either case the cost for a temporary lease would be nominal as there is ample land available in that direction. The Bee Expert himself would find very suitable quarters at "La Chaumiere" or other house in the vicinity ; this would be a matter for his personal arrangement. I doubt whether a special office would be required and I hope that the Bee-Expert would not be so bothered with correspondence as to require a special clerk. My view is that he is to be engaged on research work and that his time should be given to this.

Owing to the local type of earthquake-proof construction, building is relatively cheap in Shillong, even the largest bungalows being frame-houses built of local wood, the sides covered with reeds and plaster.

10. The enclosed statement gives an estimate of expenditure involved, both recurring and non-recurring. The figures are approximate as it is impossible to give any very exact estimate for a scheme of this kind. The total cost of the scheme is estimated to amount to Rs. 7,100 non-recurring and Rs. 90,000 recurring on the assumption that the experiments will be carried out for a period of three years.

(Sd.) T. BAINBRIGGE FLETCHER,

Imperial Entomologist, Pusa.

17th April 1930.

Enclosure : A statement of expenditure : (Annexure I).

ANNEXURE I.

Estimate for a scheme for the development of Bee-keeping in India.

Particulars.	Expenditure.			
	Non-recurring.	Recurring.		
		First Year.	Second Year.	Third Year.
	Rs.	Rs.	Rs.	Rs.
One Bee Expert on a consolidated pay of Rs. 1,500 per mensem (including Provident Fund, house accommodation or any local allowances) .. .. .	..	18,000	18,000	18,000
Cost of a return passage <i>plus</i> Railway fares ..	3,000	..	..	..
One Assistant on Rs. 200 per mensem (inclusive of all allowances) .. ..	..	2,400	2,400	2,400
Local Labour—cost of night watchman on Bee sheds and local coolies .. ..	..	1,200	1,200	1,200
One or two acres of land, fencing and temporary sheds	3,000	..	..	..
Importation of Bees (10 colonies at £20 each landed in India) and transportation of same to experiment station .. ..	..	3,000	3,000	3,000
Apparatus, such as Hives, smokers, Veils, Foundation combs, Honey extractors, etc.	600	1,900	1,900	1,900
Travelling allowance .. .. .	..	2,000	2,000	2,000
Miscellaneous, such as stationery, postage, furniture	500	1,500	1,500	1,500
	7,100			
Total cost for three years .. .. .	..	90,000		

N.B.—It is not possible to give exact figures in a scheme of this kind. It is possible that there may be savings in expenditure year after year in certain items under Apparatus and that there may be appropriations in aid on account of sale of honey, etc. Under Travelling, on the other hand, the Bee Expert may be required to make extensive tours in the 2nd and subsequent years to see conditions in other districts, so that the expenditure under this item might increase after the first year. It is equally possible that the Bee Expert might require more expenditure under apparatus and miscellaneous and less on imported bees. The approximate figure of Rs. 90,000 per year as recurring expenditure should therefore be about correct for the whole period of the scheme.

APPENDIX XXI.

REVISED SCHEME OF RESEARCH IN FRUIT-GROWING IN THE
MADRAS PRESIDENCY.

Attention is invited to the attached extract from page 33 of the Proceedings of the Advisory Board held at Simla in June 1930 regarding the scheme of research in fruit-growing in the Madras Presidency (Enclosure I) and to pages 154-158* of the Proceedings. The Government of Madras have now submitted a revised scheme (Enclosure II) for the establishment of two fruit research stations, one on the plains and the other on the Nilgiris. The plains station involves a non-recurring expenditure of Rs. 30,256 and an annual recurring expenditure of Rs. 9,18-1, while the station on the Nilgiris involves a total expenditure of Rs. 72,200 (recurring and non-recurring) over five years. It may be noted that the original scheme involved a total expenditure of Rs. 71,200 for a period of 5 years (including a capital outlay of Rs. 38,000 on buildings, lands, etc.) as against the total expenditure of Rs. 1,57,376 now proposed on two stations. The revised scheme is for the consideration of the Advisory Board.

M. S. A. HYDARI,

*Secretary.**The 6th December 1930.*

*Not printed.

ENCLOSURE I.

Extract from the Proceedings of the meeting of the Advisory Board of the Imperial Council of Agricultural Research, held at Simla on the 9th, 10th, 11th and 12th June 1930.

15. *Scheme of research in fruit-growing in the Madras Presidency.*—In introducing the scheme, Mr. Hilson stated that they in Madras could go no further in the matter of fruit research without financial help. They had already four fruit stations in Madras, namely, Samalkota, Kallar, Bulliar and Coonoor. They were also trying to encourage trade in fruits from the Nilgiris to the palins. Mr. Mitra proposed that the scheme should be deferred till interested provinces, for example, his own (Assam), had themselves put up schemes of fruit research which the Council would consider together. Mr. Milne supported Mr. Mitra. Mr. Burt was also in favour of postponement. He thought that the Council should consider the question of the steps which should be taken to promote fruit-growing in India as a whole. In the interval he wanted the Madras Government (1) to give an assurance that they proposed to relieve Mr. Butcher, who was stated to be in charge of the experiment, of other work as he considered that the experimental work of the farm would require his whole attention, and (2) to cut out from the scheme those items which were not essential to the experimental programme but designed to expand the propagation of fruit trees for distribution. Mr. Hilson, in reply, said that he did not see why the Madras scheme should be deferred because other provinces had been late in putting up their own. He was willing to give the assurance required by Mr. Burt; in regard to his second point, if any cuts were required to enable the Council to finance only that portion of the scheme which was definitely experimental, these could be made at the present meeting.

In the result, however, the Board by vote agreed that consideration of the scheme should be postponed till its next meeting; that in the interval the Madras Government's attention might be drawn to the two points raised by Mr. Burt. This interval would also enable other provinces, if they felt so inclined, to submit their own fruit schemes so that the problem could be discussed as a whole as had been done in the case of rice.

ENCLOSURE II.

Copy of a letter No. 3273-III|30-1, dated Fort St. George, the 5th November 1930, from S. T. Ramamurty, Esq., I.C.S., Secretary to the Government of Madras, to the Secretary, Imperial Council of Agricultural Research, Delhi.

In continuation of my letter No. 356-III|30-3, dated the 6th May 1930, asking for a grant of Rs. 71,200 for research in fruit-growing in this Province, I am directed to state that the Director of Agriculture of this Province has since submitted proposals for the establishment of two Research stations, one on the plains and the other on the Nilgiris. A statement showing the approximate expenditure that will have to be incurred on the station during the next five years is appended. It will be seen therefrom that the station on the plains involves a non-recurring expenditure of Rs. 39,256 and an annual recurring expenditure of Rs. 9,184, while the station on the hills involves a total expenditure of Rs. 72,000 (recurring and non-recurring) during the next five years.

As stated in my last letter referred to above, the scheme is of all-India importance and will be of use to other Provinces also. Owing to the present financial conditions, this Government is not in a position to provide for any recurring or non-recurring expenditure and so I am directed to inquire whether the Council will provide for the whole expenditure and if not, what portion the Council will be willing to provide.

Fruit Research Station—Plains.

A.—NON-RECURRING.

	Rs.
Capital outlay—	
1. Land—30 acres at Rs. 800 each including 15 per cent. compensation	24,000
2. Buildings—	
(i) Office and Store	2,500
(ii) Implement and cart shed	650
(iii) Cattle shed (for 2 pairs)	500
(iv) Farm Manager's quarters	3,500
(v) Store clerk's quarters	1,200
(vi) Coolies' sheds	600
(vii) Potting and grafting shed	900
(viii) Shed for oil engine	1,000
3. Two pairs of cattle at Rs. 300 per pair	600
4. Dead stock—	
(i) Pump and oil engine	1,200
(ii) Pipes, masonry channels and laying of the land for irrigation	1,000
(iii) Fencing	1,000
(iv) Implements and tools, etc.	600
Total	<u>39,256</u>

B.—RECURRING.

	Rs.
1. Pay of Establishment—	
1 Superintendent at Rs. 250 \times 12	3,000
1 Assistant at Rs. 100 per men-em \times 12	1,200
1 Clerk at Rs. 35 \times 12	420
1 Peon at Rs. 12 \times 12	144
1 Fieldman at Rs. 35 \times 12	420
2. Working expenses	3,000
3. Contingencies	1,000
Total	9,184
Total Non-recurring	30,256
Total Recurring	9,184

Fruit Research Station—Hills.

I. YEAR.

	Rs.	Recurring.	Non-recurring
Pay of Establishment—			
1 Upper Subordinate, 85—5—120, average pay	107		
1 Fieldman, Rs. 35—50	44		
1 Clerk, Rs. 35—60	48		
1 Peon, Rs. 12—18	151		
	214½	2,571	or 2,000
Contingencies—Miscellaneous—			
Furniture, postage stamps, etc.	500	500	
Allowance—Voted—			
Other compensatory (hill allowance)—			
1 Upper Subordinate	25		
1 Fieldman	10		
1 Clerk	10		
1 Peon	2		
		600	
Capital Outlay—			
Cost of land—			
20 acres at Rs. 200 an acre	4,000		
Clearing 5 acres	1,000		
Purchasing fruit trees	1,500		
Pitting and planting the above	500		
	7,000		7,000

Fruit Research Station—Hills—contd.

			Rs.	Recurring.	Non-recurring.
			Rs.	Rs.	Rs.
Nursery—					
Clearing 1 acre	..	..	200		
Terracing and revetting	..	..	300		
			500	..	500.
Buildings—					
Quarters for Upper Subordinate	..	..	3,000		
Quarters for fieldman	..	..	2,500		
Quarters for clerk	..	..	2,500		
Rest-house	..	..	5,000		
Office, tool and fruit store	..	..	3,500		
Drains, revetments, etc.	..	..	1,000		
Fencing	..	..	3,000		
			20,500	..	20,500
Purchase of deadstock (tools and implements)	..			..	500
Working expenses—					
Manures and chemicals	..	..	1,000		
Cooly labour and sundries	..	..	1,000		
				2,000	..
Total I year	..	..		5,700	28,500
				34,200	

II. YEAR..

Pay of Establishment	..	..	2,600	2,600	..
Contingencies—Miscellaneous	..	..	200	200	..
Allowances—Voted—Other, compensatory	..	..	600	600	..
Capital Outlay—					
Cost of land—					
Clearing 5 acres of land	..	..	1,000		
Constructing drains, revetments	..	..	1,000		
Purchase of fruit trees from Australia	..	..	1,500		
Pitting and planting	..	..	500		
			4,000	..	4,000
Purchase of deadstock—					
Tools and implements	..	..	200	..	200
Working expenses—					
Manures and chemicals	..	..	1,000		
Cooly labour and sundries	..	..	2,600	3,600	..
Total II year	..	..		7,000	4,200
				11,200	

Fruit Research Station—Hills—contd.

					Rs.	Recurring, Rs.	Non-recurring, Rs.
III. YEAR.							
Pay of Establishment	..	..	..	..		2,600	..
Contingencies	..	..	..	..		100	..
Allowances	..	..	..	..		600	..
Capital outlay—							
Cost of land (opening and planting 5 acres).	..			..		..	5,000
Purchase of deadstock—							
Tools and implements	..	..	..	..		..	150
Working expenses—							
Cooly labour and sundries	..	..				3,600	..
Total III year	..	..				6,900	5,150
						12,050	
IV. YEAR.							
Pay of Establishment	..	..	..	..		2,600	..
Contingencies	..	..	..	..		100	..
Allowances	..	..	..	..		600	..
Capital outlay—							
Cost of deadstock—							
Tools and implements	..	..	..	..	100	..	100
Working expenses—							
Cooly labour and sundries	..	..			4,000	4,000	..
Total IV year	..	..				7,300	100
						7,400	
V. YEAR.							
Pay of Establishment	..	..	..	..		2,600	..
Contingencies	..	..	..	..		50	..
Allowances	..	..	..	..		600	..
Capital outlay—							
Purchase of deadstock—							
Tools and implements	..	..	..	..	100	..	100
Working expenses—							
Cooly labour and sundries	..	..	..	..	4,000	4,000	..
Total V year	..	..				7,250	100
						7,350	

Abstract.

	Pay of establish- ment.	Con- tingen- cies.	Allowances.	Capital outlay.	Working Ex- penses.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
I year	2,600	500	600	28,500	2,000	34,200
II year	2,600	200	600	4,200	3,600	11,200
III year	2,600	100	600	5,150	3,600	12,050
IV year	2,600	100	600	100	4,000	7,400
V year	2,600	50	600	100	4,000	7,350
						72,200

APPENDIX XXII.

COPY OF LETTER FROM THE SECRETARY TO THE GOVERNMENT OF ASSAM IN THE TRANSFERRED DEPARTMENTS, AGRICULTURE BRANCH, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. 3342-E., DATED SHILLONG, THE 10TH DECEMBER 1930.

I am directed by the Government of Assam to forward a note by the Officiating Director of Agriculture, Assam, outlining a scheme for investigating the possibilities of fruit culture in this province on an organised basis, and to request that it may be laid before the Advisory Board so that it may be presented to the next session of the Governing Body with this Government's request for financial aid. As the Council are aware, the resources of the province are lamentably insufficient even for work upon the staple crops, and it is impossible to allot more than trivial amounts for the purpose of experiment in promising new fields such as this of fruit culture. The Assam Government, therefore, trust that the Council may find it possible to contribute the whole recurring and non-recurring cost of the venture, especially in view of the natural suitability of the province for expansion of fruit-growing, and also of the fact that the demands made by them upon the Council's resources have been limited by strict scrutiny of the proposals made by their Agricultural Department. The nature and scope of the scheme are fully detailed in the accompanying note.

A SCHEME FOR EXPERIMENT ON FRUIT CULTURE IN ASSAM.

1. With the large area covered by hill districts and the varying climatic and soil conditions, the possibilities of fruit growing in Assam are very large. Out of a total provincial area of 35,299,970 acres the hills comprise 13,950,080 acres, of which 11,120,826 acres are reported to be arable and only 909,652 acres are under actual cultivation. A considerable portion of the arable area in the hills could be planted profitably with fruit plants. The importance of Assam for fruits has been stressed in paragraph 515 of the report of the Royal Agricultural Commission. Most of the plains abound in "Tillas" or small hillocks, which, though not very suitable for ordinary crops, may be profitably planted with fruit trees. In the plains the cultivation of fruits, wherever possible, is likely to prove a much more paying proposition in Assam, with its labour difficulties, than many of the ordinary crops, particularly for educated farmers. The actual area under fruits, roots and vegetable is, however, reported to be only 545,293 acres, of which perhaps less than half is under fruit.

2. *Citrus fruits*.—The orange is *par excellence* the most important commercial fruit in Assam. Oranges from Assam not only supply the markets of Bengal, including Calcutta, but even find their way up to Akyab in the east, Madras in the south and Benares in the west. The fruit is grown extensively on the slopes of the Khasi Hills and is extending throughout the plains of the whole province—the present acreage being estimated as about 11,000. With proper methods of cultivation, picking and marketing, the Assam orange should find a ready market throughout India, Burma and perhaps even in Europe. Recent figures of export are not available, but the figures from 1904-05 to 1921-22 indicate an annual export varying from 29,837 maunds valued at Rs. 2,38,698 to 104,714 mds. valued at Rs. 5,44,514 through Chhatak in Sylhet, through which place most of the oranges of the Khasi and Jaintia Hills pass for export by boat. The export through other channels must be at least another 25 per cent. of this figure. Most of these oranges find their way to Bengal and other provinces, which shows the interest of other provinces in the problem of improvement of the crop. There are various problems in connection with its cultivation which require investigation.

The most serious factor limiting the cultivation of oranges in Assam is the yellowing or "die-back" of the trees, the cause of which requires further investigation. Enquiries show that this is acting as a serious deterrent to the expansion of cultivation. The most important line of investigation, however, will be the trial of suitable stocks for budding. Budding is a simple method for propagating a large number of trees in a short time, and, in the case of oranges, the budded trees may be expected to come to fruit in three years whereas a seedling would take about seven years or more. This presents an opportunity of getting a hardy root, while budded trees produce more uniform fruits and a better shaped tree than seedlings. Experiments are being made on this line at Haflong and Khanapara (Gauhati) fruit gardens but the work is restricted by limited resources. The areas both at Haflong and Khanapara require enlargement and a much larger number of plants have to be budded than the department has been able to deal with hitherto. Varieties from other provinces should also be tried. The types grown in the different parts of the province vary somewhat in quality. The most promising types should be tested and suitable selections made for different localities.

There is a large demand already for orange seedlings and grafts from within and beyond the province, which cannot be supplied. Properly developed, these two stations will be able to supply all the requirements. Grape fruits are rapidly coming into considerable importance and there are large possibilities of extension in Assam, the soils of which are suitable for most citrus fruits. "Pomellos" are already largely grown. During the last year some budded grape fruit plants were obtained from Florida and planted at Jorhat and Haflong. Some of these have come into fruit this year and a few more plants have been indentured for. Budding has also been started. It is, however, necessary to carry out systematic experiments on a more extensive scale.

In paragraph 515 of their report the Royal Commission have mentioned the transport difficulties of fruit growers in Assam. This is indeed a serious difficulty but a preliminary enquiry is necessary so that remedies may be suggested to achieve substantial results. It has not been possible to ascertain the loss caused by present methods of picking, packing and marketing of oranges but this is known to be considerable. Not only is there loss in quantity during transit, but defective methods of picking and packing are undoubtedly responsible for a considerable deterioration in value. Oranges are transported from Assam by country boats, steamers and railways. To enable the growers to get the maximum value it is necessary to make careful enquiries as to the destination of the fruit and the cheapest and quickest methods of transport. A marketing officer has, therefore, been provided in the scheme. He will make enquiries as to how the oranges are sold, their ultimate destination, methods of transport, and loss during transit, and will suggest remedies. It is very probable that action on co-operative lines will considerably reduce the losses, but for such a purpose a special trained officer is needed.

3. *Deciduous Fruits.*—The experiments on the deciduous fruits have been carried out mainly at the La Chaumiere Garden, Shillong, since 1912. It has been shown that certain varieties of apples, pears, peaches and plums can be grown successfully, and grafts have been supplied throughout the province. During the last ten years over 1,500 grafts are reported to have been supplied from the La Chaumiere Garden to various places including Barisal in Bengal and Ranchi.

4. There is now little doubt that with the selection of suitable varieties, pears, peaches, plums and certain varieties of apples can be grown in all the Khasi and Jaintia Hills, and fruit-growing can be developed as a very profitable business. It is also clear that in many parts of the hill areas deciduous fruits can be successfully grown but it is now desirable to discover which varieties are most suitable for particular areas. Experiments on a limited scale have been carried out by various persons. These have, however, not been carried out systematically or under scientific control. It is necessary to extend the experiments and keep accurate records, so that the varieties best suited to each locality may be selected.

The principal experiments to be carried out may be summarised as follows:—

1. Trial of various indigenous stocks for grafting and budding.
2. Trial of different varieties under different conditions.
3. Selection and propagation of a few definite commercial varieties and their extensive distribution.
4. Trial of various manures and fertilisers.

Incidentally experiments will also be conducted on the following lines:—

1. Control of the "woolly aphis" (*aphis lanigera*) as well as of other diseases of deciduous fruits.
2. Trial of various methods of pruning.
3. Commercial management of orchards.
4. Encouragement of private commercial orchards wherever possible, especially by supplying suitable grafts.
5. Introduction of better methods of picking, packing and marketing.

5. A good deal of work along each of these lines for deciduous fruits has already been done by the late Mr. C. H. Holder as the lessee of the Government Garden at Shillong. A large number of grafts were obtained from abroad and many of them have been successfully grown. A number of imported and indigenous stocks have been tried, but the experiments have not yet been exhaustive or

reduced to scientific form. Assam with its wealth of jungles affords a particularly fruitful field for experiments with indigenous stocks, which require further investigation.

6. It is, therefore, proposed that the experiments on deciduous fruits should be carried out at and from the La Chaumiere Garden and that on citrus fruits at the Khanapara Farm at Gauhati and the Baktiar Farm at Haflong, both of which require extension for the purpose.

7. Details about these stations are given below :—

La Chaumiere Garden.—This is believed to be one of the best gardens for deciduous fruits on this side of India. It contains an arable area of 30 acres of which 22.66 acres are under fruit trees. There are now about 6,000 fruit trees in the garden, consisting of 3,171 apples, 775 pears, 362 plums, 321 peaches and the balance of miscellaneous trees mostly in bearing condition. A large number of the trees, however, require replacement and attention. There are also a large number of grafts. The garden was started in 1912, and was under the management of Government until 1921, when it was leased out to the late Mr. Holder, previously the manager on behalf of Government, who died in August 1930. If the present scheme is accepted all experiments on deciduous fruits will be carried out at this station, which will also form the nursery for supplying grafts of these trees for the whole province and perhaps beyond. With proper development, it is confidently expected that at least 1,000 grafts can be supplied annually from this station. The station will be under the immediate supervision of a Fruit Inspector.

Khanapara, Gauhati.—This station will be used for experiments on citrus fruits and pineapples as outlined above, particularly for the Assam Valley. The present orchard consists of about three acres only and there is no room for expansion except by acquisition of some more land. There is an area of about 5 acres of suitable land contiguous to the present orchard which can be acquired. Budded orange plants will be supplied for the Assam Valley from this station. Five acres should be planted with oranges.

There are at present about 450 orange trees which are expected to come into bearing in 2 or 3 years.

Baktiar, Haflong.—This will be the main station for work on oranges and pineapples for the Surma Valley. There are now about 250 orange trees, most of which are in a bearing condition, and over one thousand seedlings. The work on budding oranges has been carried on since 1925, and some of the budded plants have come into bearing this year. This orchard requires expansion, and plenty of contiguous Government land is available. At present an Overseer is in charge but more expert supervision is required and a Fruit Inspector will be stationed here. Five acres should be planted with oranges.

8. *Staff.*—The experimental work will be at any rate for the present, under the supervision of the Economic Botanist, who had special training in fruit culture in California. The whole of his salary and travelling allowance will be borne by the Local Government. Any laboratory work necessary will be conducted at the departmental laboratory at Jorhat by the existing staff. The headquarters of the present Fruit Inspector should be removed to Shillong. He will be in charge of the work in the Khasi and Jaintia Hills and the Assam Valley. No provision for a residential building is necessary as he can easily live in the town. A Second Fruit Inspector should be appointed for the Surma Valley with headquarters at Baktiar. Quarters will have to be provided, as orchard is about three miles away from the town of Haflong and no private houses are available even in the town. It is impossible for one Fruit Inspector to manage the work of the whole province.

The Fruit Inspectors will not only look after the Government orchards in their respective circles but will also visit private gardens and give advice, for

which there is great demand, as an increasingly large number of educated people are taking to fruit growing. They will also arrange for the supply of fruit trees and grafts. Each will require a peon.

Khanapara, Gauhati.—This will be in charge of an Horticultural Assistant working under the Fruit Inspector, Shillong. As the headquarters of the Fruit Inspector will be in Shillong, it will be necessary to have a superior type of man in charge than an ordinary overseer.

Baktiar, Haslong.—The Fruit Inspector, Surma Valley, will have his headquarters at Haslong and will supervise the work of this station, which will be in immediate charge of an overseer as at present.

A grafter will be required at each of the three stations at Shillong, Gauhati and Haslong. At present there are one Fruit Inspector and one grafter at Khanapara and one overseer at Haslong. They will continue to be paid by the Department as shown in the detailed estimates.

9. If the scheme is accepted there will be a great incentive to fruit-growing, and as the whole of the produce will not be required for consumption within the province, there will be a large surplus for export and canning, in both of which the Empire Marketing Board is interested. The successful working of the scheme will benefit not only this province but consumers of fruits throughout India.

Cost of Scheme.—The total cost for a period of five years will be Rs. 78,656 after deduction of the present provincial expenditure, as shown in the abstract.

Receipts.—It is rather difficult to form an estimate of probable receipts with any degree of accuracy as there are few data to go upon. It is believed that the present receipts from the sale of fruits from La Channiere Garden will not be less than between Rs. 2,500 to Rs. 3,500 per annum. The probable receipt from sale of grafts may be estimated at Rs. 500 per annum.

Both at Haslong and Khanapara it is proposed to have about five acres under orange trees. When these come into bearing, the receipts may be estimated at Rs. 2,500 to Rs. 3,500 from each.

If the Council of Agricultural Research provides the extra funds needed the excess receipts over those for the present year will be allowed for on such terms as may be agreed upon between the Council and Government.

J. N. CHAKRAVARTY.

The 25th November 1930.

Abstract of estimates for fruit culture in Assam.

Particulars.	Non-recurring.	Not recurring for 5 years (after deducting contribution by local Government).					
	1st year.	1st year.	2nd year.	3rd year.	4th year.	5th year.	Total recurring.
1	2	3	4	5	6	7	8
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1. Fruit Experiment Station at Haflong ..	9,200	1,550	1,562	1,574	1,586	1,598	7,870
2. Fruit Experiment Station at Khanapara (Gauhati)	5,000	1,420	1,402	1,564	1,636	1,708	7,820
3. Fruit Experiment Station at Shillong.	5,000	3,910	3,922	3,982	3,991	4,051	19,802
4. Appointment of one Fruit Inspector in the Sumi Valley with headquarters at Haflong.	5,300	2,280	2,580	2,700	2,712	2,832	13,104
5. Appointment of one Marketing Enquiry Officer for one year.	..	5,500	..	..	..	..	5,500
Total ..	24,500	14,660	9,556	9,820	9,928	10,192	54,156

Estimate for the Fruit Experimental Station at Haflong.

Details.	1st year.		2nd year.	3rd year.	4th year.	5th year.	Ultimate annual
	Non recurring	Recurring.	Recurring.	Recurring.	Recurring.	Recurring.	Recurring
1	2	3	4	5	6	7	8
ESTABLISHMENT	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
One Overseer (Rs 30—1/2—50)	..	360	360	108	108	456	192
One grafter mahi (Rs 25—1—40).	..	300	312	321	336	348	381
Allowance, etc.—							
Travelling allowance ..	..	50	50	50	50	50	50
Water supply ..	2,000	..	..	..	..	..	..
Reclamation ..	500	..	..	..	..	..	..
Godown ..	2,500	..	..	..	..	..	..
Overseer's quarters ..	1,200	..	..	..	..	..	..
Labourers' shed ..	500	..	..	..	..	..	..
Quarters for grafter mahi ..	1,200	..	..	..	..	..	..
Fencing ..	1,000	..	..	..	..	..	..
Furniture ..	100	..	..	..	..	..	..
Implements ..	200	..	..	..	..	..	..
Seeds, plants and manures ..	..	100	400	100	400	400	400
Wages of labourers ..	..	1,000	1,000	1,000	1,000	1,000	1,000
Miscellaneous contingencies ..	..	500	500	500	500	500	500
Stamps, office expenses, etc., including one garden mahi.	..	300	300	300	300	300	306
Petty repairs ..	..	300	300	300	300	300	306
Total ..	9,200	2,910	2,922	2,962	2,994	3,051	3,126
<i>Debit</i> —Expenditure to be met from Provincial grant—							
One overseer ..	..	360	360	408	408	456	492
Contingencies including menial ..	..	1,000	1,000	1,000	1,000	1,000	1,000
Total deduction ..	..	1,360	1,360	1,408	1,408	1,456	1,492
Net estimate ..	9,200	1,550	1,562	1,554	1,586	1,598	1,634

						Rs.
Net non-recurring ..	..	..	..	..	..	9,200
Recurring for 5 years ..	..	..	..	..	..	7,870
Grand total ..						17,070

Estimate for Fruit Experimental Station at Khanapara, Gandhari.

	1st year.		2nd year.	3rd year.	4th year	5th year.	Ultimate annual.
Details	Non-recurring.	Recurring.	Recurring.	Recurring.	Recurring.	Recurring.	Recurring.
1	2	3	4	5	6	7	8
ESTABLISHMENT.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1 Horticultural Assistant (Rs. 60—6—120).	..	720	792	864	936	1,008	1,128
1 Grafter mali (Rs. 25—1—40).	..	300	312	324	336	348	384
Quarters for Horticultural Assistant.	2,500	..	..	..	..	..	..
Quarters for grafter mali ..	1,200	..	..	..	..	..	..
Acquisition of land (5 acres)	500	..	..	..	..	..	..
Reclamation and fencing	500	..	..	..	..	..	..
Implements	200	..	..	..	..	..	..
Furniture	100	..	..	..	..	..	..
Seeds, plants and manures	..	200	200	200	200	200	200
Wages of labourers ..	..	600	600	600	600	600	600
Miscellaneous contingencies	..	100	100	100	100	100	100
Petty repairs .. ..	..	100	100	100	100	100	
Total, ..	5,000	2,020	2,104	2,188	2,272	2,356	2,512
Deduct—Expenditure to be met from Provincial grant—1 Grafter mali.	..	300	312	324	336	348	384
Contingencies .. ..	..	300	300	300	300	300	300
Total Deduction ..	..	600	612	624	636	648	684
Net estimate ..	5,000	1,420	1,492	1,564	1,636	1,708	1,828
							Rs. 5,000
Total non-recurring							5,000
Total recurring for 5 years							7,820
Grand total ..							12,820

Estimate for Fruit Inspector in the Surma Valley with headquarters at Haflong.

Details	1st year.		2nd year.	3rd year.	4th year.	5th year.	Ultimate annual.
	Non-recurring.	Recurring.	Recurring.	Recurring.	Recurring.	Recurring.	Recurring.
1	2	3	4	5	6	7	8
ESTABLISHMENT.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1 Fruit Inspector (Rs. 125—300).	..	1,500	1,500	1,920	1,920	2,010	2,472
1 Peon (Rs. 15—1/3—18—1/6—20).	..	180	180	150	192	192	204
Allowances, etc. —							
Travelling Allowance of establishment.	..	500	500	500	500	500	500
Quarters for 1 Fruit Inspector.	5,000	..	..	..	..	..	..
Quarters for 1 peon . .	200	..	..	..	..	..	..
Contingencies —							
Miscellaneous, stamps, etc.	.	100	100	100	100	100	100
Total ..	5,500	2,280	2,580	2,700	2,712	2,832	3,276

Rs.

Total non-recurring 5,300

Total recurring for 5 years 13,104

Grand Total .. 18,404

Estimate for the Fruit Experimental Station at Shillong.

Details. 1	1st year.		2nd year.	3rd year.	4th year.	5th year.	Ultimate annual.
	Non-recurring.	Recurring.	Recurring.	Recurring.	Recurring.	Recurring.	Recurring.
	2	3	4	5	6	7	8
ESTABLISHMENT.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1 Overseer (Rs. 30—4½—50).	..	360	360	408	408	456	492
1 Graftor mali (Rs. 25—1—40).	..	300	312	324	336	348	384
Allowance, etc.—							
Travelling allowance of establishment.	..	50	50	50	50	50	50
Quarters for 1 Overseer ..	1,200	..	..	..	..	..	..
Quarters for 1 graftor mali	1,200	..	..	..	..	..	..
Godown	1,000	..	..	..	..	..	..
Labourers' shed	500	..	..	..	..	..	..
Reclamation and fencing	800	..	..	..	..	..	..
Implements	200	..	..	..	..	..	..
Furniture	100	..	..	..	..	..	..
Seeds, plants and manures ..	..	1,000	1,000	1,000	1,000	1,000	1,000
Wages of labourers .. ..	..	1,500	1,500	1,500	1,500	1,500	1,500
Miscellaneous contingencies—							
Stamps, office expenses, etc.	..	500	500	500	500	500	500
Petty repairs .. ..	..	200	200	200	200	200	200
Total ..	5,000	3,910	3,922	3,982	3,994	4,034	4,126

Total Non-recurring	Rs. 5,000
Total recurring expenditure for 5 years	19,862
Grand total ..	24,862

Estimate for the appointment of one Marketing Enquiry Officer for one year.

Details.	Amount.
	Rs.
Pay at Rs. 250 per mensem	3,000
Travelling allowance	2,000
One peon at Rs. 11 per mensem	132
Contingencies	368
Total ..	5,500

APPENDIX XXIII.

APPLICATION FROM DR. A. E. SLATER, MISSION POULTRY FARM,
ETAH, FOR A GRANT FOR 5 YEARS FOR BREEDING EXPERIMENTS
IN CONNECTION WITH THE IMPROVEMENT OF GOATS.

The enclosed application (Enclosure I) from Dr. A. E. Slater for a grant of Rs. 5,000 per annum recurring and Rs. 15,000 non-recurring or a total of Rs. 40,000 spread over a period of five years is submitted for the consideration of the Advisory Board. The Government of the United Provinces have been asked to indicate what, if any, portion of the cost of the scheme they are prepared to meet from provincial revenues. Their reply is enclosed. (Enclosure II).

M. S. A. HYDARI,

Secretary.

The 10th December 1930.

ENCLOSURE 1.

AN APPLICATION FROM DR. A. E. SLATER TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH FOR SANCTION OF A GRANT OF RS. 40,000 (RS. 15,000 NON-RECURRING AND RS. 25,000 RECURRING SPREAD OVER FIVE YEARS) FOR THE REVISED SCHEME OF THE IMPROVEMENT OF GOATS IN THE UNITED PROVINCES.

INTRODUCTION.

IN accordance with the request by the United Provinces Research Committee, I approached a number of experts in animal genetics, and asked for an expression of their views in order to enable me to draw up a more comprehensive scheme than the one first submitted (*vide* letter No. R. E.4/30 from Philip B. Richards, Esq., A.R.C.S., F.E.S., Secretary, United Provinces Agricultural Research Committee), copy of letter herewith enclosed.

Further, in accordance with a letter No. 198-E/D.O., dated August 28, from G. Clarke, Esq., C.J.E., Director of Agriculture, United Provinces, I secured personal interviews with C. H. Parr, Esq., Deputy Director of Cattle Breeding, Muttra, United Provinces, and Colonel Olver, C.B., C.M.G., F.R.C.V.S., Animal Husbandry Expert, Imperial Council of Agricultural Research, Simla, to discuss the matter with these experts, and work out technical details. I am glad to be able to report that both these gentlemen approved of my scheme, and gave me most valuable assistance in drawing up a comprehensive revised scheme. The following experts also expressed their views by letter :—

Colonel J. Matson, O.B.E., I.A., Director of Southern Circle, Jubbulpur ; Captain S. G. M. Hickey, Civil Veterinary Department, Lucknow ; both heartily supported my scheme. Replies are expected shortly from F. J. Gossip, Esq., Livestock Expert, Government of Bengal, and Professor F. A. E. Crew, Director of Imperial Bureau of Animal Genetics, University of Edinburgh, Scotland.

Lines of research.—My revised scheme calls for three lines of research.

- (a) Experimentation with Swiss Toggenberg goats, to test their suitability for Indian conditions, and to determine whether they will reproduce themselves pure in India, without serious loss of vigour. Should they prove satisfactory, *i.e.*, show themselves to be hardy for village milk production, and at the same time produce greater yields than that obtained by selective breeding from the best indigenous breeds, such as the Jumnapari and Barbary, then the future policy could well consist of producing pure-bred bucks in the country, for grading purposes on village herds. It is *not proposed* to go on importing high-priced bucks continuously.
- (b) Selective breeding of the best Jumnaparis by means of recorded milk yields and produce tests.
- (c) Selective breeding of the best Barbary by means of recorded milk yields and produce tests.

Our purpose then in (b) and (c) would be to endeavour to form *improved pure-bred flocks* of these two breeds by careful and good, but not high feeding, and keeping them pure in separate herds. Grading up we would endeavour to do, by selective breeding for milk yield and prolificacy, under village conditions of maintenance, but with every care to maintain health and condition throughout the year. In this way, by adhering continuously to pure-bred animals of similar type herds, we should in time succeed in building up herds of good milk yielding goats.

Cross-breeding.—Alongside these pure-bred herds we might carry on cross-bred herds, the foundation females of which would be of the same breeds as the two pure-bred herds, so that a fairly reliable comparison of results could be obtained.

By carrying on cross-breeding with these females and their progeny, into the third and fourth generation, and making careful comparisons of milk yields over all costs and prolificacy, in each succeeding generation of pure-breds and cross-breds, we should in time obtain valuable data on which to base a policy for the future.

Continuity—Continuity is to our minds essential. We believe that breeding on the above lines should be carried on continuously during the whole period of the experiment, and that changes of policy during that time are *not desirable*.

Summary of the object of the experiment.—To observe by careful records kept over a series of consecutive generations, maintained under good village conditions:—

(1) The comparative results obtained by selective breeding of pure-bred Jumnapari and Barbani goats and pure-bred Toggenbergs.

(2) The comparative results obtained from—

(a) First crosses between pure-bred Toggenbergs and village does.

(b) First crosses between bucks of the two selected Indian breeds and village does.

(c) Subsequent matings of the $\frac{1}{2}$ and $\frac{3}{4}$ breeds thus obtained with pure-breds.

Records—Careful records should be kept on the following:—

(1) Comparative milk production and the food consumed.

(2) Hardiness and prolificacy.

(3) Time of reaching maturity and food consumed up to that time.

(4) Comparative age of commencing milk production in first lactation, and the comparative amount of food consumed, including dry periods per 100 lb. of milk produced.

(5) Milking longevity, i.e., the average number of profitable lactation per doe

(6) The average interval between kiddings.

(7) The estimated average value of hair, and hide and carcasses.

It is at once apparent that a *generous provision* must be provided for adequate trained assistance for such work as that outlined in this revised scheme. Mr. Pari suggested that a B. Sc. in Agriculture, who has specialized in dairying was essential.

Grants-in-aid.—After a long consultation with Mr. C. H. Pari, as to what would be required in the way of buildings, stock and equipment, the following was arrived at:—

Non-recurring.

Buildings—

	Rs.
Quarters for trained assistant	2,500
Herdsmen's quarters	1,000
Dairy building and office	2,000

Stock—

(a) Toggenbergs—1 male, 10 females, 11 \times 300	.. 3,300
(b) Jumnaparis—1 male, 20 females, 30 \times 25	.. 750
(c) Barbaris—2 males, 28 females, 30 \times 25	.. 750

*Non-recurring.**Equipment—*

	Rs.
Sheds and kidding pens with enclosures for 100 breeding stock and kids	2,500
Fencing	1,000
Dairy equipment	500
Office equipment (including typewriter)	600
Weighing scales (for stock)	100
Total ..	15,000

Recurring.

	Rs.
Lease of grazing rights and lease for 5 acres of cultivated land (100 goats at Rs. 10 per head per annum)	1,000
<i>Feed and keep—</i>	
Cultivation	400
Herdsmen—5 men—1 at Rs. 25, 4 at Rs. 14	972
Farm contingencies	500
Office contingencies	328
Trained assistant for keeping research records at Rs. 100—5—200	1,800
Total ..	5,000

The least amount therefore that the plan outlined above can be carried on with is a non-recurring grant of Rs. 15,000 and a recurring grant of Rs. 5,000 per annum for five years, and we would therefore respectfully make application for these amounts.

Conclusion.—The opinion of all those who have expressed their views is that our scheme is a sound one and well worthy of support. It might also be added that no records are available in India on milkgoats, and no research work has been carried on. These points were brought out clearly in the replies to my questions, and the only farm herd of goats maintained by Government in India is we understand at the Cattle Farm at Hissar. The only printed information we could obtain is a bulletin, "The Economic Value of the Goat" by Mr. Williams, Principal, Agricultural College, Lyallpur.

It might be pointed out also that the Lindlithgow Commission made certain recommendations on goats in their report, and it is our considered opinion that the problem of the "poor man's cow" in India needs the sympathetic, adequate and continued support of Government.

No. R.M.14/30, dated Cawnpore, July 9, 1930.

From—PHILIP B. RICHARDS, Esq., A.R.C.S., F.E.S., Secretary, United Provinces Agricultural Research Committee, Cawnpore,

To—DR. A. E. SLATER, Mission Poultry Farm, Etah.

With reference to your application through the Director of Agriculture, United Provinces, to the Imperial Council of Agricultural Research for grants in 1925ICAR

connection with your experiments in improving the milk of goats, I have the honour to inform you that the United Provinces Agricultural Research Committee considered your application and that it was approved.

2 The Committee therefore recommended that a non-recurring grant of Rs. 1,350 and a recurring grant of Rs. 1,000 per annum for five years should be asked for from the Imperial Council.

Owing to the number of applications before the Advisory Board of the Imperial Council of Agricultural Research, it was not possible for them to include this recommendation in the agenda of their meeting in June. I presume that it will be placed before the Advisory Board at the next cold weather meeting.

3. The United Provinces Research Committee considered that the question of the milk yield of goats was of vital importance to the poor classes in this province, and instructed me to communicate with you suggesting that you should get into touch with experts in the subject of animal genetics with the object of preparing a more comprehensive scheme for future work.

4 My personal interpretation of the feeling of the United Provinces Agricultural Research Committee is that the scheme as proposed by you will prove to be on too small a scale to solve the problem, but that, before they would be prepared to recommend a sufficient grant to provide for the thorough investigation of the inheritance and improvement of milk yield in goats, they would require to be convinced that the best advice available had been obtained as to the plan of investigation; and that provision was included for trained assistance competent to deal with the genetical aspect of the problem.

5 I trust you will give this matter your consideration and will shortly be able to place before the Committee a scheme for future extension on the lines suggested.

ENCLOSURE II.

LETTER FROM THE DEPUTY SECRETARY TO THE GOVERNMENT OF THE UNITED PROVINCES, AGRICULTURE DEPARTMENT, TO THE SECRETARY TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 931-A, DATED THE 13TH DECEMBER 1930.

SUBJECT :—*Application for a grant by Dr. A. E. Slater for research work on goat breeding in the U. P.*

With reference to the correspondence resting with your letter No. 247-Vet., dated November 24th, 1930, on the above subject, I am directed to say that Dr. Slater's scheme has been examined by the Imperial Council's Expert in Animal Husbandry and the Deputy Director in charge of cattle breeding in this province and certain changes have been made at their suggestion. The United Provinces Government consider that the scheme, as passed by the Provincial Agricultural Research Committee is a sound one and, therefore, commend it to the consideration of the Advisory Board of the Council at its next meeting.

2. In accordance with the principles governing grants by the Imperial Council, the expenditure of Rs. 5,500 on buildings and that of Rs. 3,500 on account of sheds, kidding pens and fencing, proposed in the revised scheme, should ordinarily be met by this Government, but in the present state of provincial finances there is little likelihood of their finding this amount for some years to come. If the principle is adhered to literally, this scheme of all-India importance will have to be held up. This Government, therefore, recommend that this may be treated as a special case and the entire expenditure, initial and recurring for a period of five years, be met by the Imperial Council.

APPENDIX XXIV.

PRODUCTION OF AGRICULTURAL CINEMA FILMS.

At its meeting in December 1929 the Advisory Board recommended that one or more Indian officers should be selected and sent to England for training in cinema production and that in the meantime if funds permitted an expert from England should be obtained with the assistance and at the expense of the Empire Marketing Board. The Governing Body accepted this recommendation in so far as the selection and sending to England of two Indians at the expense of the Empire Marketing Board was concerned.

2 As the next step Mr. H. A. F. Lindsay, the Indian Trade Commissioner in London, with whom the scheme had originated was addressed as to how the Council should proceed further in regard to the matter. It is now proposed to give two Indians 6 months' training each in India under the Cinema Expert of the Railway Board after which one would be selected for training abroad and would be sent for final training under the best available conditions, whether in England, Germany or Canada; further that the Council should offer to bear the salary of the officer selected during the whole of the period of training but that the Empire Marketing Board should be asked to bear the cost of the travelling expenses from India, during the deputation in England, Germany or Canada, and back to India again together with a subsistence allowance and any other incidental expenses during the period of training.

3 It has also been ascertained from the Railway Board that they are prepared to train two Indians under their Cinema Expert subject to certain conditions.

It is for the Advisory Board to consider whether the proposal as now altered by the Indian Trade Commissioner and under which a financial liability not contemplated before will fall on the funds of the Council is worth pursuing. If the Advisory Board recommends that it should be proceeded with, the Board is requested to lay down in broad outline the duties which the Cinema Expert will have to perform on his return after training.

M. S. A. HYDARI,
Secretary.

21st November 1930.

The Railway Department (Railway Board) are quite willing to take two film officers for training in the Central Publicity Bureau on the following terms :—

- (i) The Imperial Council of Agricultural Research will be responsible for the pay and allowances of the two film officers while attached to the Central Publicity Bureau.
- (ii) The two film officers will travel on railways on duty passes in the same way as other officers in the Central Publicity Bureau do.
- (iii) The two officers will be available for any work undertaken in the Bureau, but the Bureau will take in hand at once the preparation of a film on any suitable subject selected by the Imperial Council of Agricultural Research, the cost of the preparation of the negative of the film being borne by the Council but not to exceed Re. 1 per foot. The Imperial Council of Agricultural Research will pay the actual cost of any positive copies required by them. This will come to about five annas a foot.
- (iv) The two film officers will remain under training for six months, at the end of which time, the specialist film officer will submit a report as to which of the officers is more suitable for selection for further training in England. This period is proposed on the assumption that the two film officers will have had some film experience before being selected.

2. The Railway Department would point out for the information of the Imperial Council of Agricultural Research that the conditions have changed considerably during the last few months and that there will be some difficulty in getting suitable training for the officer in the silent film production as they understand that no companies of repute are now producing silent films. The technique of talking films is totally different from that of silent films.

(Sd.) N. CALDER.

The 1st July 1930.

APPENDIX XXV.

TESTING OF INDIAN AGRICULTURAL PRODUCTS IN ENGLAND.

In July last the Indian Trade Commissioner in London raised the question of the procedure to be followed in future in the case of testing of Indian agricultural products in England and *inter-alia* made the suggestion that the Imperial Council of Agricultural Research should be regarded as the proper authority in India to which such requests should be addressed in the first instance so as to make the most of such facilities as can be obtained. In brief, the proposal implies (1) that all requests for the testing in Great Britain of Indian agricultural products should, in the first instance, be addressed to the Imperial Council of Agricultural Research, and (2) that, once undertaken, the results of such tests should be communicated to the Council.

2. The Government of India (Education, Health and Lands Department) and the Local Governments including the North-West Frontier Province but excluding the Government of Burma from whom a reply is expected have agreed to the proposals explained in paragraph 1 above. They are now submitted to the Advisory Board for information.

M. S. A. HYDARI,
Secretary.

The 15th December 1930.

Extract from letter dated the 16th July 1930, from the Indian Trade Commissioner, India House, London, to the Vice-Chairman, Imperial Council of Agricultural Research.

You will remember the ease of the milling and baking tests which are being carried out under the auspices of the Empire Marketing Board on behalf of Pusa. Subsequently various Provincial authorities desired to get similar tests made by direct reference to research institutions in this country. In the present instance Dr. Shaw was apparently unaware of the results of malting tests which had already been carried out by Mr. Lloyd-Hind on behalf of various Provincial Governments in India. There appears therefore to be a considerable lack of organisation both in the methods adopted to get agricultural produce tested in this country and also in the dissemination in India of the results of such tests.

In these circumstances I am desirous to suggest that the Imperial Council of Agricultural Research should be regarded as the proper authority to which requests for the testing of Indian agricultural products should be addressed in the first instance. Applications which the Imperial Council decide to pass on should then be referred to the High Commissioner, who is in touch with many institutions in this country and is able to elicit their support and to settle detailed questions arising during the course of the research operations. I am to suggest that this procedure would make for efficiency and that the approval of the Government of India and of Local Governments be obtained with a view to its adoption in similar cases in future.

APPENDIX XXVI.

APPLICATION FROM THE GOVERNMENT OF MADRAS FOR A GRANT
FOR RESEARCH WORK ON POTATOES.

Attention is invited to the attached letter (Enclosure I) from the Government of Madras, No. 2931-III:30-1, dated the 3rd November 1930, in regard to the grant for work on potatoes at the Experiment Station, Nanjanad, in the Madras Presidency. A note containing a brief history of the Station with a short account of local agriculture is also attached (Enclosure II). The scheme involves a non-recurring expenditure of Rs. 8,000 for quarters and Rs. 20,000, recurring, spread over 5 years, or a total expenditure of Rs. 28,000. The scheme is submitted for the consideration of the Advisory Board.

M. S. A. HYDARI,

Secretary.

The 2nd December 1930.

ENCLOSURE I.

LETTER FROM THE SECRETARY TO THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, DELHI, No. 2931-III/30-I, DATED THE 3RD NOVEMBER 1930.

I am directed to address the Council of Research in the matter of a grant for work on potatoes.

2. At present work on potatoes is being done on a restricted scale at Nannjund on the Nilgiris and is confined to the testing of strains of potatoes, methods of cultivation and manuring for this purpose and the station is under the control of the Curator, Botanical Gardens, Ootacamund, who is also in charge of the fruit stations on the Nilgiris. The staff at present employed on the station is as follows :—

- (1) One Upper Subordinate.
- (2) One Lower Subordinate.
- (3) One Prolationer.

And a statement showing the expenditure incurred on the station during the last five years is enclosed.

3. The Director of Agriculture of this Province proposes to take up work on the production of new strains of potatoes and their distribution for seed purposes and is willing also to undertake to supply seed for test to all other Governments in India. As the work on fruits done in this Province is proposed to be expanded, the Curator will have no time to attend to the work on potatoes now proposed to be done and so the Director of Agriculture has proposed the following additional staff.

- (1) One Gazetted Officer on Rs. 250—25—750 to be in charge of the work.
- (2) Substitution of the existing Lower Subordinate at the Station by an Upper Subordinate.
- (3) A fieldman on Rs. 35—1½—50.

Quarters for items 1 and 3 above will also have to be provided at a cost of Rs. 8,000.

4. The scheme is of all-India importance as the Provinces of Bombay, Assam, Central Provinces and Berar, Punjab and United Provinces are all interested in work on potatoes. Barring item (2) specified above in the last paragraph, the expenditure that will have to be incurred on the scheme during the next five years is as follows, assuming that the work can be started on 1st April 1931.

1931-32	..	..	Rs. 3,135 plus Rs. 8,000 for quarters
1932-33	..	..	Rs. 3,738.
1933-34	..	..	Rs. 4,056.
1934-35	..	..	Rs. 4,374.
1935-36	..	..	Rs. 4,692.

5. As this Government are already incurring an average annual expenditure of Rs. 75,000 in this connection, while other Provinces also will be benefitted by the scheme and as the recurring expenditure involved is small, I am to request that the Council will be pleased to provide both for the recurring and non-recurring expenditure during the next five years.

LOSEICAR

*Statement showing the amount spent for the Agricultural Research Station,
Nanjanaad, for the years 1925-26 to 1929-30.*

Particulars.	Expenditure during				
	1925-26.	1926-27.	1927-28.	1928-29.	1929-30.
	Rs.	Rs.	Rs.	Rs.	Rs.
Pay of establishment	2,577	2,028	2,015	2,746	2,517
Allowances—					
voted—					
Travelling allowance	264	106	185	76	175
Other compensatory	664	504	618	624	536
Honoraria, voted	15	..	10	..	5
Miscellaneous	116	77	165	36	50
Works—New Works and Petty Construction and Repairs.	9,181	591	83	1,312	698
Capital outlay	861	304	300	227	198
Working expenses	5,025	9,431	9,418	11,005	11,400
Charges payable to Government departments and others.	300	300	300	300	300
Total	10,903	13,401	13,784	16,416	15,879

ENCLOSURE II.

BRIEF HISTORY OF THE POTATO EXPERIMENT STATION, NANJANAD,
WITH A SHORT ACCOUNT OF LOCAL AGRICULTURE.

The Potato Experiment Station was established in 1917 after a good deal of time had been spent in selecting the site. It is situated about halfway between the village of Kuruthukulli and Nanjanad. Easy access by motor to the station is now possible by a road constructed to it. This road branches off at Andy's Corner on the Governor's Shola Road. The distance to the Potato Experiment Station from Ootacamund is 10½ miles. The station was originally scrub jungle and grass land and a portion of it appears to have been cultivated many years ago. The soil is typical of that to be found on the Nilgiris and is therefore somewhat poor. It is all dry land excepting two acres of swamp. The Station is exposed to the south-west monsoon the winds of which usually damage the haulms of the potatoes. The area of the station is 90.16 acres and the portion at present under cultivation measures approximately 36 acres. The chief crop is potatoes, but koral, samai are grown in rotation and lupins are grown as a green manure crop. The objects of the station are (1) to import and grow disease-free potatoes of good varieties and to distribute them to the ryots for seed purposes at a reasonable price, (2) to experiment with the different kinds of manures to find out which are the best for the district, (3) to carry out various experiments with green manure, rotation of crops, etc., and (4) to encourage the ryots to adopt more up-to-date methods of cultivation and to grow better varieties of potatoes than they usually do. Two crops of potatoes are grown annually, the first being planted in March and the second in August. The best time to see the station is during the months of May and November, the crop then being in full growth.

2. The much needed spring showers usually commence during the first week of April and if the rain is sufficient, the potatoes planted in March soon commence to grow. Everything depends on these early showers, and if they do not occur or if they are light, the growing period of the crop is shortened; for when the monsoon sets in about the 10th June the high winds which accompany it blow the haulms to pieces and growth is slow. Moreover "Early Blight" (*Alternaria solani*) sets in and destroys the leaves. Towards the end of August a second crop of potatoes is planted, but these do not grow so rapidly as the first crop, the "seed" not having been kept so long, the shoots are therefore weaker; this altogether with the uncertainty of the North-east monsoon and the liability of frosts occurring in November, makes the second crop an uncertain one and it is called a "seed crop", i.e., for use for planting purposes in February and March. With careful storage, however, and an up-to-date storeroom it is possible to keep the crop lifted in July and August until the following March, but such "seed" is more useful for planting in February in drained swamps or where irrigation is possible.

3. The crop grown by the surrounding ryots include potatoes, barley, koral, samai, amaranthus, onions and other vegetables. The ryots' methods of potato cultivation are extremely primitive and it is a common sight to see them planting potatoes little larger than a marble. The "sets" are often planted so close as 6" apart in the rows and 15" between the rows. Cattle manure is used at the time of planting, but in limited quantities, as it is difficult to obtain. Koral is sown on poor land without any cultivation other than ploughing a few inches deep, no manure being applied as a general rule. After koral has been grown the land is allowed to lie fallow for some years. The cattle kept by villagers are extremely poor and give little milk; the buffaloes are much finer animals, the coarse grass of the Nilgiris apparently suiting them better than it does other cattle. Much of the wornout land around the Badaga villages should be planted with Wattle (*Acacia dealbata*) or other quick growing tree to provide fuel for the villagers as the women have to go miles to collect

wood for cooking purposes. Such wornout land if regenerated as described above would provide valuable arable land for future generations. Wild pigs do an incredible amount of damage to the crops, and much expense is incurred in erecting walls and making trenches, etc., around the farms.

4. The ryots practise rotation of crops in a small way and they are beginning to appreciate the value of green manure crops and fertilizers.

Glossary.

English or local names.			Botanical names.
Samai .. ..	..	..	<i>Panicum miliare.</i>
Korali .. ..	..	..	<i>Setaria glauca.</i>
Tenai .. ..	..	..	<i>Setaria italica.</i>
Barley .. ..	..	..	<i>Hordeum vulgare.</i>
Lupins .. ..	..	..	<i>Lupinus sp.</i>
Potatoes .. ..	..	..	<i>Solanum tuberosum.</i>
Kikuyu grass .. ..	..	..	<i>Pennisetum clandestinum.</i>
Prairie grass .. ..	..	..	<i>Bromus unioloides.</i>

APPENDIX XXVII.

PARTICIPATION OF INDIA IN THE INTERNATIONAL DAIRY CONGRESS, COPENHAGEN, 1931.

India has been invited to participate in the Ninth International Dairy Congress which is to be held at Copenhagen in July 1931. A copy of the preliminary programme* of the Congress is enclosed. The question whether India should participate in the Congress is now for the consideration of the Advisory Board. If a delegation is sent the cost will fall on the funds of the Council.

M. S. A. HYDARI,

Secretary.

The 10th December 1930.

*(Not printed).

APPENDIX XXVIII.

REPRESENTATION FROM MESSRS. KIRLOSKAR BROTHERS, LTD., IN
REGARD TO RAILWAY FREIGHT RATES FOR AGRICULTURAL
IMPLEMENTS.

The attached representation (Enclosure I) from Messrs. Kirloskar Brothers, Ltd. in regard to railway freight rates for agricultural implements, is submitted for the consideration of the Advisory Board. Attention is, in this connection, invited to the letter from Major F. H. Budden, the Chief Publicity Officer, Railway Department (Railway Board), and a member of the Advisory Board (Enclosure II). It may be explained that though the representation in question was circulated to the members of the Advisory Board in connection with the subject of mechanical cultivation in India at its meeting held at Simla in June 1930, it was not discussed.

M. S. A. HYDARI,

Secretary.

The 28th November 1930.

ENCLOSURE I.

Letter from Messrs. Kirloskar Brothers, to the Secretary, Imperial Council of Agricultural Research, No. 514, dated the 18th April 1930.

With reference to the report of the meeting of the Research Council appearing in to-day's "Times of India", we find that the question of granting favourable rates to agricultural implements has not been given that attention which it deserves. It has been attempted to show therein that the agricultural implements have been given all the facilities that could be given but we maintain that the agricultural implements have not been given any concessions since the publication of the agricultural report, but on the contrary manures have been given by the Railway Board enormous concession. Just to illustrate our point further, we have to draw your attention to the fact that prior to the publication of the report, the manures were carried at Rs. 16|8|0 per ton from Bombay to Kolhapur and agricultural implements were carried at Rs. 17 per ton over the same distance but after the publication of the report the manures are carried on at Rs. 5|4|0 per ton from Bombay to Kolhapur where the rate for agricultural implements remains the same.

As a matter of principle, the indigenous industries ought to be given greater facilities but instead of doing that facilities are being given to the importers of chemical manures and we have therefore to draw your attention to this grievance and place these facts before the next meeting of the Council.

We are also enclosing herewith a copy of our letter addressed to the Railway Board for your perusal and guidance.

Trusting our case will receive favourable attention and thanking you in anticipation.

Reference No. 514.

To

The Deputy Director,
Railway Board,
Government of India,
Railway Department.
New Delhi.

18th March 1930,

SUBJECT :—*Railway freight rates for agricultural implements.*

DEAR SIR.

We have to acknowledge receipt of your letter No. 978-T., of 20th February 1930, and we have very carefully considered the reasons put forth by you for refusing our demand for concessional rates on agricultural implements, and we still regret to say that the reply is not convincing and hence unsatisfactory.

You have quoted in *extenso* paragraph 109 of the Agricultural Commission and say you have done all you could in giving us concessional rates, but if you carefully go into the previous records and see you will find that the agricultural implements are being carried at first class rates since the last ten years and even the manures were carried at the same rates, but after the recommendation of the Agricultural Commission, the manures have been specially classified and are now being carried at specially reduced rates so much so that whereas previously the cost of carrying manures say from Bombay to Kolhapur was Rs. 16|8|0 per ton, the said manures are now being carried on at Rs. 5|4|0 and the agricultural implements carried at first class cost Rs. 15 from Kirloskarvadi to Bombay a distance of 50 miles shorter than the distance

between Bombay and Kolhapur. We fail to see how manures can be said to be of greater importance to the agriculturists than the implements, as in our opinion, both are equally essential and if any comparison were to be made implements can be said to be of prime necessity to a farmer as manures are of no use unless the land is first ploughed.

As a matter of fact the Agricultural Commission has recommended that concessions in freight should be given to the manufacturers of agricultural implements in India, but the present rates charged, as pointed out above, are not concessions at all, but on the contrary, facilities for transport of raw material from the sources of supply to the factory and the finished products from factory to the places are being refused to the manufacturers of agricultural implements. Whereas the dealers in chemical manures who mainly deal in imported stuff are given enormous facilities the indigenous manufacturers of agricultural implements are refused any concessions in rates which we think is unfair. You will further see that in paragraph 109 of the Agricultural Commission's report, the Commission have recommended special rates for the carrying of raw materials to the factory and even though they are now classified as 2nd class no special concession has been given for the carrying of raw materials from the source of supply to the factory.

In your letter No. 978-T., dated 16th January 1930, addressed to the Indian Merchants' Chamber, Bombay, you state that even before the recommendation of the Royal Commission on Agriculture, you had gone into this question and certain machines have been re-classified as Agricultural Implements. This fact has been brought out to show that manufacturers of agricultural implements have been given special concessions. But in this respect what has been done by you is only this. Certain implements such as sugar-cane mills drawn by bullocks, etc., were classified by the Railway in 2nd class as machinery whereas similar mills when imported entered the country duty free being classified in the Tariff Schedule as agricultural implements, we therefore pointed out to the Board that whereas, at one place, the Government was classifying the sugar-cane mills, etc., as agricultural implements they are classifying them on railway under the head of machinery which was an obvious injustice and after a good many representations, the Railway Board agreed to classify the sugar-cane mills, etc., under the head of agricultural implements. By this the Railway Board agreed to remove an injustice to which the manufacturers of agricultural implements were long subjected.

Lastly, as stated by you, we had applied to the Railways concerned to give us some special concessions, but they all have refused to accede to our request and we enclose herewith the copies of their replies for your perusal.

We therefore trust you will consider our representation more sympathetically.

Yours faithfully,

KIRLOSKAR BROTHERS, LTD:

N. W. GURJAR.

Copy of the letter from the Deputy Director, Government of India, Railway Department (Railway Board), to Messrs. Kirloskar Brothers, Ltd., Kirloskaravadi, No. 978-T., dated the 20th February 1930.

SUBJECT:—Railway freight rates for agricultural implements.

With reference to the discussion which two of your representatives had with a Member of the Railway Board on the 17th instant when a request was made for a reduction in the railway freight rates for agricultural implements, I am directed to state that the Railway Board have given further consideration:

to the reasons put forward for a reduction. These reasons, as stated by your representatives, were :—

(a) The recommendations of the Agricultural Commission.

(b) The fact that manures are carried at the minimum rate below which railways are not permitted to reduce their rates, and that agricultural implements are of as great value to agriculturists as manures.

2. I am to say that as regards (a), the Royal Commission on Agriculture in India suggested in paragraph 109 of their report that freight rates on agricultural implements and machinery should be re-examined from the point of view that it is greatly to the interest of railways to encourage internal manufacturers by charging the lowest possible rates for the movement to the factory of raw material and from the factory of the finished article all over the country, and that, where possible, concessions should be given. As explained in the Railway Board's letter* No. 978-T., of the 12th January 1929, the classification for agricultural implements and machinery had been examined by the Railway Board who sanctioned the following alterations :—

Previous classification.		Present classification.	
R. R. O. R.		R. R. O. R.	
Agricultural implements (not machinery)—		Agricultural implements and machines not worked by their own power—	
Packed	1	Packed	1
Unpacked	3	Unpacked	3
Agricultural implements (machinery) charged in as machinery		Ditto worked by their own power	
. 4		. . . . . 2	

It will be seen from this that agricultural implements and machines not worked by their own power have now the lowest classification, viz., 1st class (0.38 pie per maund per mile) at railway risk when packed and at owner's risk when unpacked.

3. As regards the comparison of the rates for manures with those for agricultural implements and machines, I am to say that the Railway Board cannot accept the contention that freight rates for the latter should be influenced by those charged for a commodity like manures with which there can be no reasonable basis of comparison.

4. I am to add also that the Railway Board regret that they can see no reason in this case to depart from their practice of leaving it to railway administrations concerned to quote rates within the maximum and minimum of the class in which a commodity is placed. They are, however, sending the principal Railways a copy of this letter, and are asking them to consider favourably any representation you may make to them direct for the quotation of special rates for long distance traffic, more especially in full wagon loads, where such action can be taken with due regard to circumstances and without exposing railways to a charge of undue preference.

(Sd).

Deputy Director, Railway Board.

*Not received.

ENCLOSURE II.

LETTER FROM MAJOR F. H. BUDDEN, CHIEF PUBLICITY OFFICER, INDIAN STATE RAILWAYS, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. C. P. O.-45-LIG., DATED SRINAGAR, THE 14TH JUNE 1930.

I note that certain correspondence with Messrs. Kirloskar Bros. was printed in the agenda for the meeting of the Advisory Board of the Imperial Council of Agricultural Research during June 1930, in connection with the question of mechanical cultivation in India. This correspondence was not, however, referred to by any of the Members but as I presume that a reply will be sent to Messrs. Kirloskar Bros., I would like to bring the following points to your notice.

2 Messrs. Kirloskar Bros. argue that, because the rates for manures have been recently considerably reduced, the rates for agricultural implements should also be reduced. There are many factors which influence the fixing of rates and probably the two most important are the value of the commodity and the cost of transport. The cost of manure per ton is lower than the cost of agricultural implements per ton and it is an accepted principle that commodities of low value cannot bear the same rates as those of high value, as in the former case, the railway freight forms a considerable portion of the retail charge, whereas in the latter case it is often only a very small proportion. Railways have to earn a certain amount of money to cover the cost of running the railway and their overhead charges, and so it has been found that it is advantageous both to the consignor of low-priced commodities as well as to the consignor of high-priced commodities, that the rate for the low-priced commodity should be comparatively on a lower scale.

3. The cost of transport is an important factor, and it is obviously cheaper for a railway to haul a wagon fully loaded than to haul a wagon carrying only a small proportion of the possible capacity in tons of that wagon. It is difficult to obtain a high average load with wagon loads of certain classes of agricultural implements and so it costs a railway more per ton of freight to haul a wagon loaded with such agricultural implements than a wagon fully loaded as the tare weight of the wagon remains the same.

4 Messrs Kirloskar Bros. have made no attempt to show that the rate charged for agricultural implements is not reasonable, as the mere fact that the rate charged is higher than the rate charged for manures does not prove that the existing rate is not reasonable and one that the traffic cannot bear.

5. In paragraph 3 of the letter, dated 18th March to the Railway Board from Messrs. Kirloskar Bros it is stated that facilities for transport of raw material from the source of supply to the factory are not given by the railways. The most important raw material in the manufacture of agricultural implements is probably steel bars and sheets. This commodity is placed in Class II with a maximum rate of .42 pie per maund per mile. A special through rate from Tatanagar to Kirloskarvadi has, however, been quoted for steel bars and sheets and this rate works out to .28 pie per maund per mile. Railways have, therefore, given a reduction of 33 per cent. in the rate and so it is incorrect to state that no facilities have been given.

6. All commodities in India are placed in one of the ten classes and for each class a maximum rate has been fixed by the Railway Board beyond which railways are not allowed to charge. There are in addition literally thousands of special rates quoted by railways for all classes of commodities. Railways quote such rates because sometimes they consider that the traffic cannot bear the maximum of the class rate. at other times they hope to obtain an indirect benefit by a greater use of a certain commodity which will increase the despatch of other commodities (such a commodity is manures), or because the quoting of a lower rate will enable a producer considerably to increase his output. The latter has also an important bearing on the cost of transport as the cost of transporting a

commodity is higher for the initial distances and gradually decreases until it becomes constant. The changing of a special rate or the quoting of a new special rate requires a careful examination of all existing rates for that commodity and of similar commodities to work out the effect of such a special rate. A knowledge of local conditions is also essential. It is obvious, therefore, that it is quite impossible for the Railway Board to have the necessary information available to enable them to interfere in the quoting of special rates and this is rightly left to individual railways, the Railway Board being responsible for placing the various commodities in the different classes and for laying down the maximum and minimum rates for each class.

7. I would accordingly suggest that in the reply to Messrs. Kirloskar Bros. it should be stated that the Advisory Board do not agree that a just comparison can be made between manures and agricultural implements as there is a considerable difference in the value of these two commodities and in the cost of transport to a railway. It should also be pointed out that the mere fact that a lower rate is quoted for manures does not prove that the rate for agricultural implements is not reasonable and no attempt has been made to show that the existing rate is one that the traffic cannot bear or that a reduction in the rate will increase the total number of agricultural implements sold in India and not merely the number sold by Messrs. Kirloskar Bros. Messrs. Kirloskar Bros. might also be informed that it is understood that definite facilities have been provided by railways by the reduction of rates for the transport of raw material from the source of supply to the factory and that the statement made in paragraph 3 of their letter, dated March the 18th, is incorrect. A suggestion might be made that the Railway Board is not the correct body to whom applications should be made for special rates. Agricultural implements have already been placed in Class I or the lowest class and any further reduction must be obtained by the quoting of special rates by railways. It may be added that it is understood that the Railway Board have advised all railways that all applications for special rates for agricultural implements should be treated with careful consideration and obviously this will be done by railways as it is to their interests to encourage the transport of any article which is likely to improve the outturn from agriculture.

APPENDIX XXIX.

ASSISTANCE TO BE GIVEN BY THE INDIAN RAILWAYS CENTRAL
PUBLICITY BUREAU TO PROMOTING AGRICULTURAL AND
VETERINARY DEVELOPMENT.

Attention is invited to the attached memorandum by Mr. W. T. Aldous, Commercial Officer, Indian State Railways, Central Publicity Bureau, in regard to the subject mentioned above. The memorandum outlines possible directions in which railways can be of assistance to agriculture (including animal husbandry) in India and is submitted for the consideration of the Advisory Board.

M. S. A. HYDARI,
Secretary.

The 12th December 1930.

**MEMORANDUM FOR DISCUSSION AT THE NEXT MEETING OF THE ADVISORY BOARD
OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.**

SUBJECT :—*Assistance to be given by the Indian Railways Central Publicity Bureau and by Railways in promoting improved agricultural and veterinary methods.*

1. Demonstration Trains.—(a) *Provincial.*—The Punjab and Bengal Governments have co-operated with the North Western and Eastern Bengal Railways respectively in the running of Demonstration Trains in the past but some of the other Local Governments, although approached, have not seen their way to allotting the necessary funds. This year it is probable that the Punjab and Bengal Governments will not join in running any trains due to financial stringency. It is understood that Governments that have taken part in these trains believe fully in their efficacy as a medium of propaganda, and it is to be decided how funds are to be provided for them in future. The railway charges represent the cost of running only, and it is understood that these are but a small proportion of the cost of the train, so that even if railways were to reduce these charges, it would not solve the financial difficulty.

(b) *All-India.*—A proposal has been made to organise such trains on an All-India basis, with a tour of anything from three to eight months, covering the greater part of India either in one or more tours. There is some difference of opinion as to whether this proposal is feasible, owing to the different languages that would have to be used, and the changes necessary in staff for the same reason. A saving in cost would, however, be effected as only one set of exhibits would be required for all the provinces covered, but here again the question arises as to whether one set of agricultural exhibits would be suitable for the whole area. It has to be decided whether this proposal is practicable, and, if so, how it is to be financed. The normal railway charges amount to about Rs. 600 per unit of half a bogie carriage per mensem, or Rs. 7,200 a month for a train of six bogies.

2. Films.—Most of the larger railways now run regular cinema cars, and it is generally felt that this is a valuable medium of propaganda among audiences which are largely illiterate, especially if a lecturer is present to explain the films. The Imperial Council of Agricultural Research have had under consideration the appointment of two film production officers and it is a matter for consideration whether the appointment of these men should not be expedited. These men could also undertake the preparation of lantern slides for lectures. Suggestions are invited as to suitable subjects for films and slides for the encouragement of the better production of crops, and generally for raising the standard of living.

3. Visits by Cultivators to Model Farms.—There appears to be some difference of opinion as to whether cultivators should be encouraged to visit model farms, or whether demonstration plots only should be used for this purpose. A suggestion has been made that parties of about fifty cultivators should pay regular visits to model farms throughout the year, or at suitable times of the year, and that railways might then agree to the quotation of concession rates for such parties at one and a half fares for the return journey. It has to be decided whether such visits are to be encouraged and the idea proceeded with.

4. Other methods by which Railways can assist Agriculture.—Railways have an extensive machinery in existence throughout India which might be usefully employed in distributing propaganda for better agricultural methods, or possibly even in the exhibition and sale of improved implements at stations. The views of the Council are invited on this subject.

5. Liaison between Railway and Agricultural interests.—The question arises whether the present system provides adequate touch between railways and agriculture or whether some better means of liaison would be desirable. It might be advisable to have a definite officer working with the present Central Publicity

Bureau, which would interest itself and railways in agricultural requirements and act generally as a clearing house between the two departments. In that case *Publicity Officers on railways, working under their Agents, would develop a similar interest in agricultural requirements, and would keep the railway officials interested in such matters.* This is purely a tentative proposal, but the views of the Council on it would be welcomed.

N. B.—The above note has been submitted by the Railway Member on the Advisory Board as a basis for discussion, and any decisions arrived at would require the approval of the Railway Board and the Railways concerned.

APPENDIX XXX.

, DRY-FARMING RESEARCH SCHEME FOR THE BOMBAY DECCAN.

Attention is invited to the attached letter from the Government of Bombay No. 5088-A/24, dated the 14th November 1930, and of its enclosure, regarding a dry-farming research station for the Bombay Deccan. The scheme, which is explained fully in the printed pamphlet, provides, in addition to a central research station for subsidiary stations located in the districts of Bijapur, Ahmednagar and Ahmedabad respectively. The scheme as a whole has the support of the Government of Bombay with this modification that the local Government do not consider a centre in the Ahmedabad District essential for the investigation proposed.

2. The scheme involves a total expenditure of Rs. 3,98,151 for a period five years (Rs. 68,741 non-recurring and Rs. 65,882 per annum recurring). Excluding the cost (estimated at Rs. 45,112) of the sub-station in the Ahmedabad District not recommended by the Government of Bombay, the cost of the scheme which is now for the consideration of the Advisory Board, is reduced to Rs. 3,53,039 for a period of five years. The Government of His Exalted Highness the Nizam have also, as suggested by the Government of Bombay, been approached in the matter. Their reply is awaited.

M. S. A. HYDARI,

Secretary.

The 13th December 1930.

Copy of a letter No. 5688-A/21, dated Bombay Castle, 14th November 1930, from G. K. Joshi, Esquire, I.C.S., Under-Secretary to the Government of Bombay, Revenue Department, to the Secretary, Imperial Council of Agricultural Research.

SUBJECT :—Dry-Farming Research Scheme. Application for a grant-in-aid for the—*for the Bombay Deccan.*

With reference to your letter No. 1817-Genl., dated 17th September 1930, I am directed by the Government of Bombay (Transferred Departments) to forward 100 copies of the Dry-Farming Research Scheme (Annexure) for the Bombay Deccan prepared by the Agricultural Department in this Presidency and to state that the problem of dry-farming is not wholly a provincial one. The conditions in the adjoining country are very similar notably in the Hyderabad State and parts of Madras. The Scheme was laid before the Provincial Agricultural Research Committee at its meeting held on 13th October 1930. The Committee has asked this Government to commend the scheme to the favourable consideration of the Imperial Council of Agricultural Research. The Government of Bombay support the scheme as a whole. They would however urge that no centre should be opened in the Ahmedabad District as it is not essential for the investigation proposed. Besides, it increases the difficulties of control and adds unnecessarily to the cost. They also consider that the Imperial Council of Agricultural Research should approach the Government of His Exalted Highness the Nizam with a view to securing their participation in the scheme. I am to add that the question of the contribution to be paid by this Government towards the cost of the scheme can be settled by negotiation hereafter.

ANNEXURE.

DRY-FARMING RESEARCH SCHEME FOR THE BOMBAY DECCAN.

THE PROBLEM.

One of India's greatest problems in the past has been famine. The development of easy transport and the opening up of the labour market have done much to mitigate the human suffering associated with famine; but these have had no effect upon the agricultural conditions which bring about crop failure. Agriculture over the greater part of India is still a gamble in rain, and in no part of the country is this more true than in the Bombay Deccan, perhaps the most precarious tract in the whole of India.

It has been computed that nearly one-third of the total area of the Bombay Presidency (excluding Sind) is very liable to periodic famines and scarcities due either to the total failure of the rains or to their unsuitable distribution. Another one-third of the area is also liable to famine though more rarely. The former tract embraces the districts of Ahmednagar, Sholapur and Bijapur in the East Deccan and the eastern portions of Poona, Satara, Belgaum and Dharwar Districts. This tract contains about 25 per cent. of the total population of the Presidency while the less liable tract contains about 38 per cent. of the Presidency population. Thus the two tracts taken together contain about 63 per cent. of the entire population of the Presidency.

Apart from gratuitous relief and the suspension and remission of land revenue, the Bombay Government has spent over 10 crores of rupees on irrigation works in its efforts to strengthen the economic condition of the Deccan. Nevertheless the total irrigated area in any district does not exceed seven per cent. of the total cultivated area. The rest of the land depends upon rain.

WORK DONE SO FAR BY THE DEPARTMENT OF AGRICULTURE.

The Bombay Department of Agriculture has, so far as its limited resources admit, been working on this problem for some years. This work falls into two divisions—

(a) Dry-farming research.

(b) Bunding operations.

As regards bunding operations it may be pointed out that there is an indigenous practice among the people to construct field embankments to prevent the rain flood-water running to waste and scouring the land. A study of this work revealed the fact that most of these embankments were unscientifically designed and hence steps were taken to assist the public as regards the design and construction of these embankments. There are now four whole-time officers engaged on this work and their services are very greatly appreciated. Thus in 1928-29 32 schemes (including plans and estimates) were prepared in the Bijapur District alone. The average cost of these village bunding schemes worked out at about Rs. 1,500. In addition 22 schemes in this district were prepared for the reclamation of small mulla beds. Much time was also devoted to the inspection of previously executed works and advice, where necessary, was given as regards repairs.

Dry-farming research was started in a small way at Manjri near Poona six years ago. The establishment consists of an officer, one graduate assistant, one clerk, one laboratory boy and two peons.

The equipment consists of a piece of land measuring some 5 acres and a small laboratory. The budget amounts to

Pay of officer at Rs. 520 ..	6240	Rs. 11,842 as indicated in the margin. The re-
Pay of Establishment ..	3,192	search work done on this dry-farm experimental
Contingencies ..	2,410	station having an annual average rainfall of

LOGSTON

20.01 inches (varying from 11.38 to 25.91), indicates the great possibilities of turning the available rainfall to better account in an average year and of making grain production a practicable proposition in a bad year when it would ordinarily fail. By the intelligent application of dry-farming methods an average crop, even in a year of considerable drought, can be produced on soils of reasonable depth.

It has been ascertained that the amount of water taken up by the crop from the rain-water-supply can be increased by about 1½ acre inches (*i.e.*, over 60 per cent). This means an additional yield of about 1,000 lb. of dry weight (350 lbs. grain and 650 lbs. fodder) per acre. In bad years it is this extra water which makes the difference between grain failure and a fair crop.

The following table summarizes the important results of yields obtained on the Dry farm at Manji during the last six years under a varying rainfall.

Year	1924	1925	1926	1927	1928	1929
Annual rainfall ..	25.91	14.38	19.63	22.01	20.59	17.91
Yields of jowar grain, pounds per acre	1,095	115	1,017	1,340	1,361	1,255
Yields of jowar fodder, pounds per acre	3,047	1,235	1,565	3,170	2,718	1,917

The yield on this land in 1929-30 without the dry-farming methods (*i.e.*, managed as the cultivator manages the land) was per acre :—

					lbs.
Grain .. .. .	..	..	..	..	811
Fodder .. .. .	..	..	..	..	1,270

while the corresponding yield on the plot managed according to the dry-farming methods was :—

					lbs.
Grain .. .. .	..	..	..	..	1,255
Fodder .. .. .	..	..	..	..	1,917

A modest estimate of the value of the increased gross yield which a cultivator could obtain by adopting the dry-farming methods would be Rs. 5 per acre; and the total area of rabi-jowar in the three districts of Ahmednagar, Sholapur and Bijapur is over three million acres. If, therefore, we assume that, at least, one-third of the land is suitable for dry-farming methods (on a count of the character of the soil) the annual aggregate gain to the agriculturists would amount to a very large figure if this method were generally adopted.

Sufficient has been said to indicate the possibilities of dry-farming methods in the Bombay Deccan and of its great economic significance to the country.

Hitherto owing to the limited resources of the Department for this research, and because it has been necessary to plan the work in such a way as to give quick results which could be easily appreciated by the public, it has been necessary to confine attention to comparatively simple investigations. Very little intensive fundamental research has so far been possible. It is, however, a matter of first class importance to undertake comprehensive research as soon as circumstances permit.

RESEARCH PROPOSED.

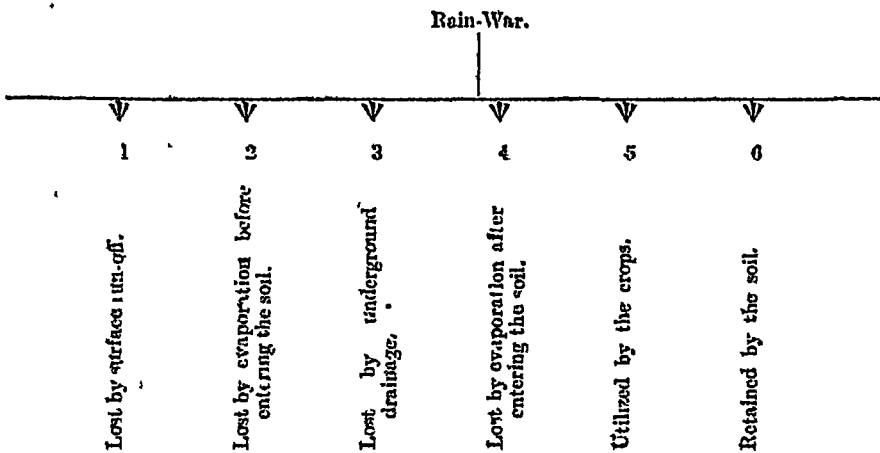
It is accordingly proposed to promote such a scheme of Research with the assistance of the Imperial Council of Agricultural Research. The work to be done falls into three divisions :—

- (1) The Soil,
- (2) The Plant, and
- (3) The Field.

In the soil division the following problems demand intensive study :—

- (a) Soil-classification.
- (b) Disposal of the rain-water in different soils receiving different treatments under varying conditions of topography.

From the following diagram it will be seen that there are six possible fates awaiting the rain-water :—



- (c) Properties of different soils, receiving different treatments, with special reference to—

- (1) Penetration of rain-water after each fall of rain on cropped and fallow land ;
- (2) Evaporation of soil-moisture on cropped and fallow land ;
- (3) Water-holding capacity ; porosity, hygroscopic coefficient, capillarity, moisture equivalent and wilting coefficient.

In the Plant division the following problems demand similar intensive study :—

- (a) The water requirements of different crop-plants with special reference to transpiration and the quantity of water required to produce a pound of dry matter ;
- (b) The root-systems of different crop-plants ;
- (c) Meteorological factors including winds, humidity ; temperature and sunshine ; and the reactions of crop-plants to these factors.

In the Field division the problems to be solved include—

- (a) Conserving the maximum quantity of the rain-water in typical soils under varying environments with special reference to surface-gradients.

This work includes—

- (1) the comparison of deep and shallow cultivation with reference to their influence upon the absorption of rain-water by the soil ;
- (2) testing the value and best methods of making small bunds to control rain-water and erosion ;
- (3) testing the value of surface-cultivation after each fall of rain ;
- (4) testing the value of inter-cultivation at different periods of the life of the crop
- (b) Finding the implements best calculated to achieve the objects of dry-farming ;
- (c) Ascertaining the best treatments for different crops grown under the dry-farming system with special reference to seed-rates, spacings and manure ;
- (d) Adjusting dry-farming methods to the economics of the farm.

The whole value and significance of dry-farming is governed by economics. In each tract of country one pair of bullocks is deemed necessary for the cultivation of a given area of land (sown according to a given system). If dry-farming methods involve more work it follows that more bullocks and men will have to be maintained during the busy seasons. Against this it is to be noted that agriculturists have a great deal of spare time in the off-seasons in the famine zone. It is obvious, however, that the ideal methods likely to be suggested by the research done in the soil and plant sections will have to be materially modified to make them fit into the economics of the farm and hence the importance of this adjustment work is very great.

Moreover it appears necessary that this field work should be done at several centres representative of the famine zone. It is therefore proposed that in addition to the centre where the fundamental research is done there should be three other centres, making four in all, where this adjustment of treatments to economics can be carried out. At each of these plots certain important observations and determinations would also be made in order to enable the staff to interpret correctly the behaviour of the crops. These would include—

- (1) determinations of soil-moisture at different depths in plots receiving different treatments, at least once per month throughout the year ;
- (2) determinations of the depth of penetration of rain-water after every substantial fall of rain, and the observation of the time when the upper and lower moistures meet ;
- (3) meteorological observations including rainfall, temperature and humidity.

ORGANIZATION REQUIRED.

LAND.

From the foregoing sections it will be gathered that the soil and plant research will be done at one centre, and that in addition to this centre there will be three centres where field research is undertaken, making four centres in all.

It is considered that the vicinity of Sholapur would be the most suitable centre for the main research and that the other centres should be—

Bagewadi in Bijapur District,

Ahmednagar in Ahmednagar District, and

a place to be selected in Ahmedabad District.

The area of land required at each centre would be 40 acres except the principle centre where 50 acres would be necessary. Thus 170 acres of land in all will be required to be rented at an estimated rental of Rs. 12 per acre.

STAFF.

The staff required would consist of :—

Principal Centre.

	Per mensem. Rs.
One Chief Investigator Class I rank (Rs. 320 to 1,200), starting on say	760
One Class II Officer (Rs. 250—20—750) starting on ..	410
One Senior Assistant in Grade I of Subordinate Agricultural Service (Rs. 220—10—300) starting on ..	250
Two Senior Assistants in Grade II of Subordinate Agricultural Service (Rs. 150—5—200) starting on ..	175
One Junior Assistant in Grade III of Subordinate Agricultural Service (Rs. 105—5—140) starting on ..	125
Three Non-graduate Fieldmen (on Rs. 30—5½—80) starting on	50
One Laboratory boy (on Rs. 18—1—20) starting on ..	18
One Clerk Accountant (on Rs. 85—5½—100) starting on ..	85
One Junior Clerk (on Rs. 30—5½—80) starting on ..	40
One Naik on Rs. 20	20
Two peons on Rs. 18	18

Three Sub-Centres.

Three Senior Assistants in Grade II of Subordinate Agricultural Service (on Rs. 150—5—200) starting on ..	175
Three Junior Assistants in Grade III of Subordinate Agricultural Service (Rs. 105—5—140) starting on ..	125
Three Non-graduates (on Rs. 30—5½—80) starting on ..	50

BUILDINGS.

I. Residential and Office.—It is proposed that the staff at the principal centre should find their own quarters in Sholapur town, but that the following subordinate staff should be provided with kutcha quarters on the site of the plot :—

- (1) One Junior Assistant in Grade III of the Subordinate Agricultural Service.
- (2) Three Non-graduate Fieldmen.
- (3) One Laboratory boy.
- (4) Three peons.

II. Laboratory.—It will be necessary to construct a good laboratory building at the principal centre. ..

III. *Miscellaneous*.—Kutcha buildings to accommodate cattle, stores implements and coolies will be necessary at the principal centre.

IV. *Three sub-centres*.—(a) Kutcha quarters will have to be provided for the staff

(b) Kutcha buildings to accommodate cattle, stores, implements and coolies will be necessary.

(c) A small laboratory will be necessary.

EQUIPMENT.

The following equipment will be required :—

I Laboratory fittings at principal centre and at three sub-centres.

II Livestock and Deadstock at all four centres

III. Fencing 6,580 feet at principal centre and 17,220 feet at three sub-centres.

IV Land improvements at all four centres.

V. Ly-ineter, Pot-culture House, etc., at principal centre.

VI. Office furniture at all four centres.

VII. Reference books at principal centre.

ESTIMATES.

The detailed estimates will be found in Accompaniment I.
The summary estimates are as follows :—

Non-recurring.

Item.	Cost in rupees.		
	Principal centre.	Three sub-centres.	Total.
Buildings	12,205	17,775	29,980
Equipment	23,550	15,111	38,761
Total ..	35,855	32,886	68,741

Recurring.

Item.	Average cost in rupees per annum.		
	Principal centre.	Three sub-centres.	Total.
Pay of officers .. .. .	..	..	15,480
Pay of Establishment	13,812	13,500	27,312
Allowances and Honoraria .. .. .	..	..	5,300
Contingencies	6,000	10,500	17,700
Total ..	..	..	65,882

It will thus be seen that the total cost of the scheme is Rs. 3,98,151 for a period of five years. The contribution which the Bombay Department of Agriculture can make to this expenditure is Rs. 59,210 made up as follows :—

Item.	Annual amount in rupees.	Total amount in five years in rupees.
Pay of Staff	6,240	} 59,210
Pay of Establishment	3,102	
Contingencies	2,410	

T. F. MAIN,

Director of Agriculture,

Bombay Presidency, Poona.

Accompaniment I.

DETAILED ESTIMATES.

NON-RECURRING EXPENDITURE.

Buildings.

Principal Centre.

				Cost in rupees.
I. Residential and Office (kutchra quality)				6,005
Type of staff.	No. of persons.	Square feet required.	Rate per square foot in rupees.	Cost in rupees.
Graduate ..	1	553	1.50	830
Non-graduates ..	3	450 × 3 = 1,350	1.50	2,025
Coolies*	5	800	1.50	1,200
Office	4	52 × 25 = 1,300	1.5	1,950

II. Laboratory (temporary quality)—

55 × 25 = 1,375 at Rs. 3 per square foot 4,125

*These include one laboratory boy and one peon.

				Cost in rupees.
<i>III Miscellaneous (lutch'a quality)</i>				2,075
Type of building.	Square feet required.	Rate per square foot in rupees.	Cost in rupees.	
Cattle shed (3 pairs)	25 × 20 = 500 ..	1.75	875	
Store	40 × 15 = 600 ..	1.25	750	
Implement shed	20 × 10 = 200 ..	1.25	250	
Manure pit and rain-gauge ..	..	..	200	
Total for principal centre				12,205
<i>Each Sub-Centre,</i>				

<i>I. Residential (lutch'a quality)</i>				Cost in rupees.
				2,225

Type of staff.	No. of persons.	Square feet required.	Rate per square foot in rupees.	Cost in rupees.
Graduate	1	553	1.50	830
Non-graduate	1	450	1.50	675
Coolies	3	480	1.50	720

II. Laboratory and office (temporary quality)—

40 × 15 = 600 square feet at Rs. 3 per square foot 1,800

III. Miscellaneous (lutch'a quality) 1,000

Type of building.	Square feet required.	Rate per square foot in rupees.	Cost in rupees.
Cattle shed (2 pairs)	20 × 20 = 400 ..	1.75	700
Store	40 × 15 = 600 ..	1.25	750
Implement shed	20 × 10 = 200 ..	1.25	250
Manure pit and rain-gauge ..	..	..	200

Total for each Sub-Centre .. 5,925
 Therefore total for three Sub-Centres 17,775
 Grand total for Principal and three Sub-Centres .. 20,980

Equipment.

	Rs.	Cost in rupees.
<i>I. Laboratory fittings—</i>		
(a) At principal centre	10,000	
(b) At three sub-centres (Rs. 300 each)	900	
	<hr/>	10,900
<i>II. Livestock and Deadstock—</i>		
<i>Principal Centre.</i>		
(a) 3 pairs of cattle	1,050	
(b) Implements	600	
(c) Weighing machine	300	
	<hr/>	1,950
<i>Three Sub-centres.</i>		
(a) $2 \times 3 = 6$ pairs of cattle	2,100	
(b) 3 sets of implements at Rs. 600	1,800	
(c) 3 weighing machines at Rs. 300	900	
	<hr/>	4,800
<i>III. Fencing—</i>		
(a) Principal Centre 6,580 feet at Rs. 1,000 per mile —	2,300	
(b) 3 Sub-centres $5,740 \text{ feet} \times 3 = 17,220$ at Rs. 1,000 per mile =	6,411	
	<hr/>	8,711
<i>IV. Land Improvement—</i>		
(a) Principal Centre 50 acres at Rs. 20	1,000	
(b) 3 Sub-centres $3 \times 40 = 120$ acres at Rs. 20	2,400	
	<hr/>	3,400
<i>V. Lysimeters—</i>		
Pot culture house and other structures at principal centre		7,000
<i>VI. Office furniture—</i>		
(a) At principal centre	400	
(b) At three sub-centres (Rs. 200 each)	600	
	<hr/>	1,000
<i>VII. Reference books</i>		1,000
<i>L92SCIAR</i>		

Name of head.	Budget Estimates,				
	1st year.	2nd year.	3rd year.	4th year.	5th year.
THREE SUB-CENTRES.	Rs.	Rs.	Rs.	Rs.	Rs.
<i>Pay of Establishment.</i>					
Three Senior Assistants in Grade II of Subordinate Agricultural Service (Rs. 150-5-200) starting on Rs. 175 per mensem each.	6,300	6,480	6,660	6,840	7,020
Three Junior Assistants in Grade III of Subordinate Agricultural Service (Rs. 103-5-140) starting on Rs. 125 per mensem each.	4,500	4,680	4,860	5,040	5,220
Three Non-Graduate Assistants on Rs. 30-5/2-80 starting on Rs. 50 per mensem each.	1,800	1,800	1,980	1,980	2,160
	12,600	12,960	13,500	13,860	14,400
<i>Allowances and Honoraria</i>					
Travelling Allowance	2,000	2,000	2,000	2,000	2,000
Conveyance Allowance as under—					
One officer in Grade I @ Rs. 75 per mensem.					
One officer in Grade II @ Rs. 50 per mensem.	3,300	3,300	3,300	3,300	3,300
Five Subordinate (three Graduate Assistants and two Clerks) @ Rs. 30 per mensem each.					
Total ..	5,300	5,300	5,300	5,300	5,300

Contingencies.

Serial number.	Item.	Average annual cost in rupees.
<i>Principal Centre.</i>		
1	Rent of land 50 acres \times 12 rupees	600
2	Field-section	2,500
3	Soil-section	2,000
4	Plant-section	1,000
5	Office incidental expenditure including stamps and periodicals	300
6	Annual repairs to buildings	500
	Total ..	6,000
<i>Each Sub Centre.</i>		
1	Rent of land 40 acres at Rs. 12 per acre	480
2	Field operations	2,000
3	Laboratory expenses and requisites	800
4	Office incidental expenditure	100
5	Annual Repairs to buildings	250
	Total for each sub-centre ..	3,630
	Total for three sub-centres ..	10,890

APPENDIX XXXI.

ESTABLISHMENT OF AN AGRICULTURAL RESEARCH STATION AT RISALEWALA (NEAR LYALLPUR) FOR WORK ON THE WATER REQUIREMENTS OF CROPS.

The establishment of an Irrigation Research Station was under consideration as far back as 1917 when the All-India Board of Agriculture recommended that the Government of India should set up a Hydrological Station on a large scale. In 1919, at a meeting of certain Irrigation and Agricultural Officers of the Punjab, it was decided to frame a Provincial Scheme with a view to its possible future expansion into an Imperial Scheme. No progress has been made in the matter.

The subject of Irrigation research is a matter of immense importance to several of the Provinces in India and whilst the results which would be obtained at any one research station in India might, owing to climatic and other conditions, not be applicable in their entirety to the whole of India, they would doubtlessly throw light of the greatest value, to all-India, on many problems connected with irrigation farming.

The present position in the Punjab is that for the past five years or so an area of 300 acres of land has been set aside on the Risalewala Seed Farm as the nucleus of such a Research Station. The farm is situated at a distance of 3 miles from Lyallpur City and 5 miles from the Agricultural College and Research Institute.

The investigations which would be carried out on this station require the collaboration of an Agriculturist, a Plant Physiologist and an Engineer. It is proposed that the Professor of Agriculture should be the Agriculturist in charge and that the Agricultural Engineer should carry out the Engineering work in conjunction with the Irrigation Department. The Irrigation expert will have full control over the Hydraulic Side of the experiment.

The land at Risalewala is at present laid out for ordinary cultivation. Before hydraulic experimental work could be undertaken a complete change of layout (plan* attached) will be necessary.

LAYOUT OF LAND.

This is estimated to cost Rs. 2,73,185. All channels require to be made pucca in order that irrigation water supplied to crops may be accurately measured and additional sources of supply such as seepage as well as loss by absorption from kacha channels be eliminated. The installation of measuring weirs within each square is necessary to take measurements of all water used. Provision has also to be made for iron outlets and water level recorders.

BUILDINGS.

The estimated cost of the buildings required is Rs. 1,45,020. A Rest-house at the Risalewala farm can be utilized as a residence for the Farm Manager. For further details see Statement No. 4 appended.

STAFF.

The details of the staff required have been worked out after much discussion. The cost thereof including Travelling Allowance comes to Rs. 50,828 per annum. This includes provision for a physiologist in the grade of pay which has been sanctioned for the Class I, Provincial Agricultural Service; also for a Gazetted Officer of the rank of an Extra Assistant Director of Agriculture who will be in charge of the experimental work. It also provides for a Statistical Assistant and the necessary subordinate staff of Agricultural Assistants, Mukaddams, etc., for field and laboratory work. For details see Statement No. 3.

*Not printed.

Statements 5 and 6 show details of other expenditure such as equipment of the farm, purchase and keep of cattle, water rates, etc. The total cost of the scheme is estimated at Rs. 6,62,800 capital and Rs. 63,000 recurring,—vide Statement No. 1. The capital cost includes the sum of Rs. 2,10,000 which is the value of the land and which being Government land will not have to be purchased.

The proposal was considered by a Committee appointed by the Punjab Government to consider schemes of Irrigation Agricultural Research and their report is appended as Annexure

ANNEXURE.

REPORT OF AGRICULTURAL IRRIGATION RESEARCH COMMITTEE ON THE SCHEME FOR ESTABLISHING A HYDRAULIC STATION AT RISALEWALA.

"We considered the report and estimate submitted by the Director of Agriculture, and are of opinion that as the proposed research station is essentially for the determination of the water requirements of various crops it would obviate any likelihood of confusion if the scheme is defined as 'Station for Agricultural Research on the water requirements of Crops'."

The possibility of confusion lies in the fact that there is very great scope for research into the effect of irrigation water on soils

The engineer's duty is to bring and the tolerance of various soils with regard to the water to the field.

D. MUST.

water, a subject which is purely a function of the Irrigation Department and needs states investigation in various parts of the Province. Whereas, Agricultural Research on the water requirements of the crops embraces an entirely different line of investigation including the optimum crop obtainable per unit of water, the optimum crop per acre, the optimum size of 'Kari' for different crops and discharges, the minimum quantity of water required to avoid damage to crops and the critical period for the application of water, etc. Such research work like the complementary investigations on improved methods of applying water to the crop, cultural methods leading to water economy or to the avoidance of water strain and the effect of differential irrigation on the quality of agricultural produce, is primarily a matter for the expert agriculturist and can conveniently be carried out at Risalewala near Lallpur.

We consider that for this research work a Physiologist who would deal entirely with the Plant side of the investigation would be of greater service than the Soil Physicist allowed for in the proposed scheme. Field experiments alone are inadequate, the response of the plant to varying conditions and the indirect effect of irrigation on the other factors, controlling plant growth require careful study involving the use of modern methods of measuring plant development. We also consider that the addition of a Statistical Assistant is very essential for the correlation, etc., and charting of the day to day results and recommend the addition of a sum of Rs. 200 per mensem rising to Rs. 300 per mensem as the salary of this Assistant.

Regarding the proposed layout of the experimental area, the form of construction of the waterproof channels and the type of the various water measuring devices, etc., that are required, we recommend that the plans and specifications for this portion of the work prepared by the Agricultural Department should be submitted to Mr. E. S. Cramp, Scientific Research Officer of the Irrigation Department, for scrutiny and the benefit of his experience and advice, in order that the best arrangements possible may be obtained with regard to the distribution and accurate measurement of water supplied to the various size of plots and fields under investigation.

The methods of obtaining and keeping all records of water distribution and measurement to be decided in consultation with Mr. E. S. Cramp and all such records to be available to the Irrigation Department. The Scientific Research Officer periodically inspecting the Station to see that the water measurements are being satisfactorily maintained.

Very great benefit will be derived from the institution of this research station; the problem of the water requirements of crops is one on which reliable information has been of paramount importance since canal irrigation commenced in India and more so since the Agricultural Department came into being and has done so much to widen and improve the staple industry of the Province.

With the slight modifications mentioned above we strongly recommend the establishment of the station for agricultural research on the water requirements of

crops at an estimated cost of Rs. 6,62,785, and Rs. 60,250 per annum recurring cost. We trust that the Imperial Council of Agricultural Research will favourably consider the grant of Rs. 2,73,185 towards the capital cost and Rs. 48,150 per annum towards recurring costs."

• • • • •

E. S. CRUMP,

Scientific Research Officer, Irrigation Research Laboratory, Lahore.

D. P. JOHNSTON,

Assistant Director of Agriculture.

T. B. TATE,

Superintending Engineer, Waterlogging Investigation Circle, Lahore.

T. A. MILLER BROWNLIE,

• *Agricultural Engineer to Government, Punjab, Lyallpur.*

STATEMENT No. 1.

Summary showing financial aspects of the Agricultural Research Station at Risalewala.

	Recurring. Rs.	Non-recurring. Rs.
1. Land 300 acres at Rs. 700 per acre .. ..	..	2,10,000
2. Layout of land and construction of khals .. ..	..	2,73,185
3. Establishment	45,828	..
4. Travelling Allowance of Establishment	5,000	..
5. Buildings .. ..	..	1,45,020
6. Implements	400	9,880
7. Furniture	200	2,000
8. Other charges and contingencies	600	..
9. Water-rate, seed and manure	1,800	1,000
10. Laboratory Equipment	2,000	10,000
11. Purchase of cattle .. ..	..	9,100
12. Upkeep of cattle	7,200	2,600
	<hr/> 63,028	<hr/> 6,62,785
or say	<hr/> 63,000	or say <hr/> 6,62,600

STATEMENT No. 2.

Showing estimated cost of layout of one square of land for the Agricultural Research Station at Risalewala.

	Rs.	Rs.
(1) Layout of land per square—		
1. Levelling the old khals, at Rs. 10 per acre ..	..	275
(2)-A. Cost of making water courses with Concrete Channels (per square of 27.8 acres)—		
(a) Excavation—	Rs.	
Khal $1,100 \times 3\frac{1}{2} \times 1\frac{1}{2} \times 5'$..	20,575	
Main khal $1,100\frac{1}{2} \times 9\frac{1}{2} \times 5\frac{1}{2}$..	9,183	
	<hr/> 35,763, say 35,000 at 10 per cent.	.. 360
(b) Concrete channels—		
Small khal 5,500 } 6,000 at Rs. ..		15,125
Large khal .. 1,100 } 2-12-4 per foot. ..		3,025
(c) Iron outlets 400 at Rs. 12-8 0 each .. ..	..	5,000
(d) Measuring weirs 5 at Rs. 100 each .. ..	..	500
(e) Level Recorders 1 for two squares $\frac{1}{2}$ at Rs. .. 1,100 ..	..	550
	<hr/> 2	<hr/>
Total .. ..	..	21,835
Total cost for 300 acres or 11 squares $21,835 \times 11$..		2,73,185

STATEMENT No. 3.

*Showing detail of staff required for the Agricultural Research Station at Hissar-
wala.*

Officer and Official—

	Rs.	Rs.
(a) 1 Physiologist on Rs. 360—40—720/760—40—800— 50—1,000 (paise) 50—1,150, say	4,600	
1 Extra Assistant Director of Agriculture—200— 250—25—750 at Rs. 250	3,000	
4 Agricultural Assistants of at least three years standing—100—10—200—10—300 at Rs. 130	6,240	
1 Statistical Assistant at Rs. 250	3,000	
8 Mukaddams on Rs. 20—1—30—2—50	1,920	
1 Storekeeper on Rs. 40—2—80—2—90	480	
1 Clerk on Rs. 40—2—80—2—90	480	
1 Mistri on Rs. 40—1—80	480	
2 Peons at Rs. 14 per mensem each	336	
		20,526
(b) <i>Engineering Staff—</i>		
1 Assistant Engineer on Rs. 525—50—1,225	6,300	
1 Overseer on Rs. 80—7—250	960	
2 Sub-Overseers on Rs. 60—5—120	1,440	
1 Draftsman on Rs. 80—2—150	960	
4 Khalasis on Rs. 14 per mensem each	672	
1 Peon on Rs. 14 per mensem	168	
		10,500
(c) 2 Agricultural Assistants each on Rs. 100—10—200/ 10—300 at Rs. 100 each	2,400	
1 Laboratory Attendant on Rs. 20—1—30	240	
	2,640	
(d) 36 beldars at Rs. 22 per mensem each	9,504	
2 Chaukidars at Rs. 14 per mensem each	336	
2 Sweepers at Rs. 13 per mensem each	312	
Variable labour and harvesting allowance	2,000	
		12,152
(e) Travelling Allowance	5,000	5,000
GRAND TOTAL		30,528

STATEMENT No. 4.

Showing details of buildings required for use of staff, bullocks, godowns, etc., at the Agricultural Research Station at Risalewala.

BUILDINGS.

	Rs.
Two office rooms 16' x 16' ..	84,910
One implement shed 80' x 18' ..	
Two fodder stores 15' x 15' ..	
One bullock shed 180' x 12' for 40 bullocks ..	
Four seed godowns each 20' wide and 24', 22', 26' and 30' long, respectively ..	
Also a pucca platform 30' wide in front of the godowns ..	
Four 'C' Type quarters for Agricultural Assistants ..	
Eight 'D' type quarters for Mukaddams ..	
Eighteen 'E' type quarters for Beldars and Mali ..	
Twenty-nine 'F' type quarters for single beldars ..	
One manure pit 42' x 24' ..	
1 quarter for the Extra Assistant Director of Agriculture ..	
	(He will occupy the Risalewala farm Resthouse.)
1 quarter for Assistant Engineer ..	10,000
3 quarters for one Overseer and two Sub-Overseers ..	14,000
1 quarter for Clerk ..	2,100
1 quarter for Draftsman ..	2,100
1 quarter for Mistri ..	2,100
1 quarter for Storekeeper ..	2,100
Extension of bullock shed ..	1,080
12 culverts for roads ..	1,800
1 office room ..	5,000
2 manure pits ..	800
1 Chemical Laboratory ..	4,000
3 quarters for two Chemical Assistants and one Laboratory Attendant ..	10,000
1 Well ..	5,000
Total ..	1,45,020

STATEMENT No. 5,

Showing the implements required for the Agricultural Research Station at Rangoon.

			Rate.	Amount.
			Rs. & P.	Rs.
12 Rust ploughs	..	..	37 8 0	450
12 Heavy Roes	..	..	40 0 0	480
14 Bar Harrows	..	..	11 8 0	165
6 Big Sahasas	..	..	8 0 0	48
1 Small Sahasia	..	..	6 0 0	24
2 Big Karahi Javaliers	..	..	8 0 0	16
2 Small Karahi Javaliers	..	..	6 0 0	12
6 Cattle	..	..	120 0 0	720
1 Rape fodder cutter (Hullock press)	..	..	..	400
1 Washing machine	..	..	..	300
1 Spring balance	..	..	30 0 0	100
20 Manish ploughs	..	..	6 0 0	120
20 Spades	..	..	2 0 0	40
40 Sickles	..	..	0 8 0	30
20 Traps	..	..	1 8 0	36
20 Saws	..	..	1 0 0	20
10 Axes	..	..	1 8 0	18
10 Axes	..	..	1 8 0	18
20 Hand Tools	..	..	2 0 0	40
2 Chain Ropes	..	..	1 0 0	2
10 Ploughing Chains	..	..	4 0 0	40
10 Log Yokes	..	..	6 0 0	60
40 Small Yokes	..	..	4 0 0	160
1 Reaper	..	..	..	350
1 Winnowing	..	..	..	250
Spares	..	..	..	200
2 Cross-Crashin' Mills	..	..	220 0 0	440
2 Pans with grating	..	..	40 0 0	80
				<hr/>
				4,578 or say
				4,500
Engineering Equipment:—				
Hook, engine and complete mechanical apparatus	..	..	..	5,000
Total				<hr/>
				9,500

STATEMENT No. 6.

Showing details of Office furniture required for the Agricultural Research station at Risalewala.

Agricultural Sections.

	Rs.	Rs.
2 Big Almirahs	140	
4 Tables	130	
8 Chairs	50	
8 Paper baskets	16	
2 Stationery cabinets	20	
1 Table Lamp	6	
4 Closed iron paper trays	72	
1 Iron safe	150	
1 Cash Box	56	
1 Saddle and bridle	100	
1 Rack for keeping registers, etc.	10	
Stationery	50	
Service Stamps	50	
Registers, Forms, etc.	50	
Total		900

Engineering Section.

1 Table for Sub-Divisional Officer	50	
1 Table for Draftsman	80	
1 Table for Subordinate	30	
1 Almirah for Subordinate	70	
1 Almirah for Draftsman	100	
1 Stationery Cabinet	20	
8 Chairs and shelf	100	
2 Stools	10	
Racks, paper trays, etc.	100	
		560
Drawing material		500
GRAND TOTAL		1,060
Say		2,000

NOTE REGARDING THE ESTABLISHMENT OF A STATION AT RISALI-
WALA (NEAR LYALLPUR) FOR AGRICULTURAL RESEARCH ON
THE WATER REQUIREMENTS OF CROPS.

In most areas where the success of agricultural operations depends on the supply of water through canals, there is apt to be a conflict between the Irrigation authorities who, basing their charges on a rate per acre irrigated, wish to spread the water over the maximum area, and the cultivator who may, for his own reasons, prefer to concentrate his supply on a smaller area.

In irrigation farming important problems before the cultivator are :—

- (a) the optimum amount of water from the point of view both of outturn and of profit to use on each crop and on each field, so that he may adjust his cropping in the most economical way consistent with his water supply,
- (b) the best way to distribute over his crops the water available at each canal rotation throughout the growing period of the crops, and
- (c) the extent of the loss entailed by different degrees of deviation from the ideal.

Inter-related with these problems of the cultivator is that of the Canal Department *namely the optimum quantity of water to allow per acre. This depends not only on the amount needed per acre of each crop, but also upon the relative profitableness of different degrees of intensity of cultivation. Obviously, it must always be a loss to the State, and generally also to the cultivator, if excess of water is applied per acre instead of spreading the supply over a larger area, or increasing the intensity of cropping, or growing crops which will give a more profitable return.*

The return for the water used and the amount of water which it is best to use depend to a great extent on the physical structure of the soil, as well as on the condition of the soil at the time of sowing and during the growth of the crop. This condition, in its turn, is closely connected with the rotation of crops grown. The object of these experiments, then, is to determine the relationship between the amount of water applied per acre to each of the important canal colony crops and the yields of these crops, together with the investigation of other closely allied problems bearing on irrigation farming.

Amongst others the following lines of investigation will be undertaken :—

- (a) the water requirements of crops under various conditions of soil, cultivation, rotation, etc. ;
- (b) the economies of different systems of irrigation and the cost of water in these various systems ;
- (c) the methods of application of irrigation water ;
- (d) the study of meters, modules and outlets and their bearing on water distribution and economy ;
- (e) the effect of physical and cultural factors on the loss of water from the soil, and
- (f) the effect of different meteorological conditions on water requirements of crops.

The foregoing lines of work are not exhaustive but they indicate some of the important problems awaiting solution. These problems are common to the Punjab, the United Provinces and Sind, and though the individual crops may differ in certain cases, the general results will be of immense value to all irrigated tracts.

APPENDIX XXXII.

SCHEME FOR RESEARCH ON PLANT PHYSIOLOGY AT THE HINDU UNIVERSITY, BENARES.

Attention is invited to the application (Enclosure I) from the Benares Hindu University for a grant towards a scheme of agricultural research at the University and to the recommendations in this regard of the United Provinces Research Committee (Enclosure II). The Government of the United Provinces have forwarded the recommendations of the Provincial Research Committee without comment nor have they stated whether they propose to make any grant from Provincial Revenues towards the cost of the scheme. They have been addressed in the matter but their reply has not so far been received. It is thought however that as the scheme was prepared by the University early in 1930 and the Provincial Research Committee has made specific recommendations thereon the Advisory Board might desire to proceed with its examination.

M. S. A. MYDARI,

Secretary.

16th December 1930.

ENCLOSURE L .

APPLICATION FROM THE VICE-CHANCELLOR, BENARES HINDU UNIVERSITY, TO THE HON'BLE SIR MOHAMMAD HABIBULLAH, KT., K.C.S.I., K.C.I.E., CHAIRMAN, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, DATED THE 5TH MARCH, 1930.

I have the honour to submit for the consideration of the Imperial Council of Agricultural Research a scheme for the development of agricultural research at the Benares Hindu University.

2. *Situation and accessibility.*—In dealing with the position of Pusa the Royal Commission on Agriculture deplored the comparative inaccessibility of the Pusa Institute. They observed :—

“The choice of Pusa as a site for an all-India research institute was, as we have seen, mainly determined by the fact that a large Government estate happened to be available for the purpose. An ideal site for a central Research Institute for all-India was doubtless impossible of attainment, but we cannot but regard it as a matter for regret that the site actually selected was one six miles from a Railway Station, in an out-of-the-way district to which access from most parts of India can only be obtained by a river crossing and from all parts by a somewhat tedious railway journey.”

I beg to point out that Benares is almost the centre of India and is most easily accessible from all parts of the country.

3. *Centre of education and research.*—In another part of their Report the Commission observed :—

“It is unfortunate, from the point of view from which we are considering this problem, that Pusa was not, from the outset, an educational as well as a research institute. Constant stream of men returning from Pusa to the Provinces would have furnished an excellent means of maintaining contact between the Imperial and Provincial departments and would have placed the latter in a better position to discover in what ways the work done at Pusa could be made of value to them.”

With reference to this observation of the Commission I am to point out that the Benares Hindu University is a centre both of education and research.

4. *Agricultural Research at Benares.*—In dealing with the question of agricultural research at Indian Universities the Commission observed :—

“The position of the Indian Universities in regard to agricultural research cannot be regarded as satisfactory. The Madras, Bombay, Nagpur and Lahore Universities have faculties of agriculture. The Calcutta University has established a Chair of Agriculture and the University of Benares has now founded a similar Chair to which we make further reference in our chapter on Education, paragraph 467. But it does not appear that at any Indian University steps have been taken to bring agricultural research into close relationship with the other branches of science taught at the Universities. Agricultural research is regarded as entirely a matter for the Government agricultural colleges. It should not, in our view, be isolated in this way. In a country so large as India in which the problems involving research in every direction which must be solved if the potentialities of agricultural production are to be realised are so numerous, it is plain that Government institutions cannot cover the whole field. The importance of carrying out agricultural research in the closest touch with other branches of scientific research can hardly be exaggerated. The advantages of mutual intercourse between research workers in different fields have been

demonstrated in many countries, and Indian Universities and Agricultural Colleges can no longer afford to work in isolation. We look forward to a state of affairs in which the Universities will not only initiate agricultural research but will also undertake schemes of research the importance of which is brought to their notice by the Agricultural department. It will, we fear, be long before the Universities are in a position to take over agricultural research to the extent to which it has been taken over by the Universities in Western countries, but this is the end which should be kept steadily in view and which both the Universities and Government should endeavour to reach as speedily as possible."

I beg to inform the Council that from its inception the Benares Hindu University has kept before itself the idea of developing a Faculty of Agriculture and providing for both instruction and research in agriculture. Its department of Botany, and particularly the Plant Physiology section which forms its most important branch, has been especially developed as part of a programme of instruction and research in agriculture. When the University began its work in Plant Physiology, there was hardly any real teaching in this subject in any other Indian University and there were no students available for taking up research work in this branch. This University has slowly trained its students and raised the standard progressively in this subject.

5. *Our present equipment for carrying on Experimental Research of Agricultural Importance.*—Our curriculum has been so designed as to be of direct agricultural utility. Out of a thousand marks for the M. Sc. examination, fifty per cent. are allotted to theory. We have a full paper for Plant Breeding and another for Plant Physiology (including Phyto-chemistry and Bio-physics). We lay special stress on the improvement of crop production both from the genetical and the physiological points-of view. In addition to the above special studies, we are maintaining a high standard in other subjects—Plant Anatomy, Cytology, Plant Pathology, Ecology and Plant Geography—such as obtains in other Universities.

Out of the remaining five hundred marks, three hundred are assigned to the practical work in the subjects enumerated above in due proportions. Students are further required to submit a thesis incorporating the results of original research in Plant Physiology, in part fulfilment of the requirements for the degree of Master of Science. This must come up to the standard of publication in a recognised botanical or agricultural journal. The thesis carries two hundred marks.

It will thus be seen that while maintaining our standard sufficiently high and in keeping with that of Universities abroad, we have endeavoured to give an economic bias to the education that we impart in this subject. It is gratifying to note that other Indian Universities also have recognized the value of physiological teaching and have introduced it in their courses of study.

6. *Our degree.*—This insistence upon a sufficient practical training in research along with a sound theoretical knowledge, has given a high value to our degrees in Botany. This University was the first to have started post-graduate teaching in Botany in these provinces, and out of our twenty M. Sc.'s one has obtained the D. Sc. degree on a thesis relating to "Growth, Senescence and Rejuvenescence in Plants". There has been a good demand for the students turned out by this department and most of them are holding important and responsible positions in the various Universities and agricultural organisations (Annexure B). It is gratifying to note that those of our students who have gone abroad for degrees in Agriculture or Botany have been highly spoken of. There are at present nine students on the rolls of the M. Sc. classes who are engaged in plant physiological research on detached problems to be finished within a short and limited time. A B. Ag. from the Poona Agricultural College has joined this department for a short term training in higher agricultural

research and application from agricultural products for being admitted in order to receive higher training as to which one has not received.

7. *Want of adequate facilities.* The further development of this section of Plant Physiology has been hampered owing to want of funds.

We have for a long time projected to establish a suitable field laboratory where the work could be undertaken and carried on efficiently, but owing to the reasons stated above, its establishment has been delayed.

It is evident that we already possess, not only for carrying on work mainly under laboratory conditions in Respiration, Carbon-Assimilation, Transpiration, Growth rates and Photo-synthesis, etc. etc. They are just sufficient to fulfil the requirements of the B.Sc. course and to enable the work of the M.Sc. student on a self and directed problem being carried on. But they leave no surplus for further work by other research workers desiring themselves to hold investigations of advanced or technical importance. The scope and the ability of the work on this has therefore been limited by the absence of this provision especially on the applied side.

8. *Shortage of funds and equipment.* The establishment of an Agricultural College, equipped both for instruction and research, has been one of the cardinal objects of the High Commissioner. It is with this idea that the large amount of revenue has been assigned by the University. A scheme for such a college was prepared in consultation with Dr. R. Mann, the late Sir Ganga Ram Bhatnagar, Mr. J. B. H. Bhatnagar and other scholars, and the University has not as yet been able to raise the necessary funds for the establishment of the college. But the donations which it has so far obtained have not been sufficient to enable it to do so. Therefore without giving up the idea of an Agricultural College, the University has decided to establish an Institute of Agricultural Research. The University has accepted donations to the extent of over one lakh for providing scientific equipment in Agriculture. One lakh of this sum is earmarked for the building of a hall from the Government and the donations of Mr. J. B. H. Bhatnagar are earmarked for the building of the Institute of Agricultural Research and under it a chair of agriculture to be called the J. B. H. Bhatnagar Chair of Agriculture. The Kapurthala Industrial Board has earmarked the annual grant of Rs. 10,000 for a Chair of Agricultural Chemistry. The building of the Institute of Agricultural Research is already in the course of construction. The first floor of the building which is to cost one lakh is expected to be ready in November next.

9. Out of the land already in the possession of the University 500 acres of land is available for experimental farms in blocks of more than 50 acres. In addition to this His Highness the Maharaja of Bikaner has been pleased to sanction a permanent loan being granted to the University of nearly 2,100 acres of agricultural land between the University and the Ganges which can be used for agricultural work of various kinds. By its soil, climate and rainfall Bikaner is particularly suited for growing most of the Indian crops and developing an ideal Institute for agricultural research.

10. The Royal Commission on Agriculture emphasised the advantage of a number of science departments being grouped together at one centre. The Hindu University is particularly happy in having a number of departments of science and applied science located in one site and working in co-operation with each other. We have a College of Mechanical, Electrical and Civil Engineering with a large workshop which can help in developing agricultural engineering and in manufacturing such apparatus and implements as we may require. We have our department of Chemistry and Mining and Metallurgy which can be of great help in the study of soils, etc. Agricultural Geology. We have also departments of Chemistry and Physics well equipped for higher work. Our department of Industrial Chemistry can provide help of various kinds in the matter of current technology, of extension, etc. Our department of Zoology has specialised in Entomology. Last, though not the least, we have a well developed department of Economics which encourages the study of Rural Economics.

Appendix G will give an idea of the steps the Hindu University has already taken with the object of providing facilities for post-graduate research in Agricultural Plant Physiology which is engaging the attention of investigators all over the world. The present Section of Plant Physiology will be transferred to the Institute of Agricultural Research to form the nucleus of research in (1) Farm crops, Fruits and vegetables, (2) Agricultural Plant Physiology, (3) Physiological aspects of Plant breeding, (4) Plant Pathology and (5) Phyto-chemistry, along with soil analysis.

10. *Our needs and our proposals.*—Having thus made provision for a large separate building for housing the Institute of Agricultural Research, plenty of land for experimentation, the existing equipment of the Department of Plant Physiology and two professors to guide research, the University asks the co-operation of the Imperial Agricultural Research Council in the shape of substantial grants to help it in promoting the advancement of Indian agriculture.

The immediate requirements of the University in this connection are :—

A. Funds for completing the building of the Institute of Agricultural Research.

B. Funds for furnishing and equipping the Institute.

C. Facilities for Field work.

(1) Enclosure an area of at least thirty-five acres of land for an Experimental Farm containing a Green House, a Hot House, a refrigerating chamber (for conducting work under controlled conditions) and an Orchard.

(2) Sinking of well and fitting up of electric motor for pumping water (electric power being available).

(3) Provision for tilling the soil, manures and other requirements.

(4) Apparatus for Meteorological observations.

(5) Breeding appliances.

(6) Provision for the maintenance of the Farm.

D. Additional facilities for the laboratory.

(1) Appliances for the investigation of soil with reference to plant growth.

(2) Additional apparatus for physiological studies, viz., seed testing, water balance, respiration, assimilation, growth, energetics and cell physiology.

(3) Facilities for the study of plant materials, their origin and fate from the food-value point of view.

(4) Such histological apparatus as may be of direct help in any of the above studies.

E. Four Research Fellowships of the value of Rs. 200 per mensem to start with, and

F. Such other assistance as might be found essential for satisfactorily carrying on research work. Details of our requirements are given in the Annexures.

A general idea of the work which the Department of Plant Physiology contemplates and of its existing activities are given in Annexure C.

11. I hope the information I have placed before the Council will satisfy it that a very useful centre of agricultural instruction and research is being developed at the Benares Hindu University, and I hope that the Council will

accept the offer of cooperation of the University in the building up of such a collection, a non-recurring grant of Rs. 3,15,000 and a recurring grant of Rs. 61,275 which we ask for. The University will be glad to supply any further information that may be needed for the Council, and will, of course, always welcome the opinion and advice of the Council in providing our constant object.

ANNEXURE. A.

THE BUDGET.

Contributions of the Hindu University.

	Rs.	A.	P.
1. Agricultural Research Institute Building (First floor only, under construction)	1,00,000	0	0
3. Land for Experimental Farm and Orchard (500 acres) ..	2,50,000	0	0
4. Apparatus, etc., already at the disposal of the Department of Plant Physiology	46,000	0	0
5. Agricultural Implements (Plough, tractor, etc.), already with the University	8,000	0	0
6. Irwin Chair of Agriculture (Jodhpur investment of two lakhs to pay Rs. 1,000 per mensem)	2,00,000	0	0
7. Kapurthala Chair of Agricultural Chemistry (permanent grant of Rs. 6,000 yearly)	1,20,000	0	0
8. Contribution for a Canal (First instalment of Rs. 50,000 received Rs. 50,000 to be received this year) ..	1,00,000	0	0
Total ..	8,20,000	0	0

ANNEXURE B.

GRANT REQUIRED FROM THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

Non-recurring Grants

	Rs.	A. P.
A. Additional grant for completing the building of the Institute of Agricultural Research	1,00,000	0 0
B. Grant for general fittings and furniture for the above ..	30,000	0 0
C. Additional show cases for keeping apparatus, chemicals, glass ware, rubber goods, etc.	2,500	0 0
D. Additional physiological instruments, apparatus and other requirements for general equipment :—		
(1) Workshop and Tools	1,622	0 0
(2) Glass blowing accessories	442	0 0
(3) Microscopy and Histology	5,122	0 0
(4) Thermostats, Regulators, Stirrers, motors, shafts, etc.	3,510	0 0
(5) Thermometers, Hygrometers, etc., for initial starting of work	1,184	0 0
(6) Brushes, Stands, Tripods, etc.	1,730	0 0
(7) Furnaces, Burners, Incubators, Baths, etc.	3,979	0 0
(8) Stills and Condensers	735	0 0
(9) Grinding Mills, Presses, Mortars and Pestles	435	0 0
(10) Rubber goods and coils (for initial equipment)	635	0 0
(11) Drawing Instruments	624	0 0
(12) Initial Herbarium Equipment	340	0 0
(13) Initial Breeding Equipment	1,128	0 0
(14) Initial Filter paper and Glass Filters	530	0 0
(15) Initial Glass goods	4,012	0 0
(16) Initial Chemicals and Stains	1,325	0 0
Total	1,59,883	0 0
E. Additional Special Research Apparatus :—		
(1) Seed Testing and Germination Apparatus	1,850	0 0
(2) Assimilation Apparatus	5,637	0 0
(3) Respiration	1,912	0 0
(4) Water Balance apparatus	14,439	0 0
(5) Growth apparatus	1,253	0 0
(6) Soil Analysis apparatus	7,362	0 0
(7) Balances and Weights	1,594	0 0
(8) Electric Instruments and other goods	5,289	0 0
(9) Meteorological apparatus	1,845	0 0
(10) Other miscellaneous Special Research apparatus for cell physiology, cell chemistry and cell physics, etc.	13,845	0 0
Total	55,026	0 0

	Rs.	A.	P.
F. Additional Grant for back numbers of Journals and reference books	10,000	0	0
G. Experimental Farm, Orchard, Green and Hot Houses :—			
(1) 500 acres of land. ..			
(2) Fencing for 35 acres of land	12,000	0	0
(3) Construction of Pucca water channel	6,000	0	0
(4) Sinking two wells and fitting electric motor for irrigation (Electric power available. See recurring expenditure also)	10,000	0	0
(5) Water tank fitted with pipe for field experiments requiring water under pressure	1,500	0	0
(6) Agricultural implements other than those already in the University	300	0	0
(7) Bullocks five pairs (for the present)	750	0	0
(8) Green house, hot and refrigerating cells (as per attached design and measurements)	17,900	0	0
(9) Initial outfit for regulating the temperature of the cell	6,875	0	0
(10) Pots for culture work (earthen, wooden and of stone, etc.)	600	0	0
(11) Plants initially to be obtained for the Orchard	350	0	0
(12) Store rooms for seeds and implements	2,000	0	0
(13) Cattle shed and a small room for the cattle man	1,000	0	0
(14) Two rooms for chowkidars	1,500	0	0
Total	60,775	0	0
Grand total for non-recurring	4,14,181	0	0

Recurring.

A. Laboratory Expenditure :—

(1) Special Research apparatus to be supplemented every year	3,000	0	0
(2) Glass, porcelain and metal wares	1,350	0	0
(3) Chemicals and stains (including rectified spirit)	1,325	0	0
(4) Drawing accessories (including sectional papers and paper for drums, etc.	320	0	0
(5) Filter papers and glass filters, etc.	325	0	0
(6) Herbarium materials	90	0	0
(7) Mercury	60	0	0
(8) Rubber goods, corks, etc.	600	0	0
(9) Photographic materials	50	0	0
(10) Materials for the repairs of apparatus, etc. glass blowing, for the workshop, including charges for such repairs as cannot be undertaken by the mechanic	280	0	0

	Rs.	A.	P.
(11) Thermometers, Hygrometers, brushes, etc. ..	100	0	0
(12) Microscopic accessories	45	0	0
(13) Labels of all kinds (paper)	15	0	0
(14) General upkeep of the Laboratory	500	0	0
(15) General stationery requirements for keeping records, publications and correspondence ..	100	0	0
Total ..	7,860	0	0
B. Maintenance of the Experimental Plot, Orchard, Green House, etc.			
(1) Supply of electric charges for pumping water ..	2,600	0	0
(2) Buckets, sprayers, etc.	30	0	0
(3) New implements and repairing charges ..	80	0	0
(4) Feeding of three pairs of bullocks	750	0	0
(5) Recurring expenditure on the maintenance of Hot and Refrigerating cells	450	0	0
(6) Culture pots	100	0	0
(7) Seeds, cuttings, plants, etc.	270	0	0
(8) Manures	620	0	0
(9) Breeding requirements	225	0	0
(10) Seed storing accessories	80	0	0
(11) Special emergency field furniture, stands, etc., for conducting experiments	50	0	0
(12) Field Labels, etc.	50	0	0
(13) Miscellaneous expenditure	300	0	0
Total ..	5,705	0	0
C. Additional Current Journals and references particularly on Agriculture and allied subjects			
	2,000	0	0
D. Contingencies (including construction of special apparatus, payment of railway, postal and shipping charges, buying dusters, chalk, and other sundries for frequent use) ..			
	1,500	0	0
E. Research Staff .—			
(1) Research Professors 2 @ Rs 500—50—1,000 ..	24,000	0	0
(2) Research Fellowships @ Rs. 200 per mensem at least FOUR fellows to start with	9,600	0	0
(3) Research Lab. and Field Assistant, one 75 rupees per mensem	800	0	0
(4) Lab. Assistant (to be in charge of store also) ..	600	0	0
(5) Fine mechanic @ Rs. 60 per mensem, one ..	720	0	0
(6) Typist and record keeper (also to be in charge of library, etc.), @ Rs 60 per mensem ..	720	0	0
(7) Artist, @ Rs. 60 per mensem one	720	0	0

	Rs	A.	P.
(8) Field Supervisor, with practical experience of local conditions, crop plants, breeding and horticulture and farm management @ Rs. 200 per mensem ..	2,400	0	0
Total ..	39,560	0	0

D. Inferior Staff :—

(1) Lab. bearer, one, @ Rs. 15 per mensem ..	180	0	0
(2) Lab. boys, 2 @ Rs. 12 per mensem ..	288	0	0
(3) Field boys, 2 @ Rs. 12 per mensem ..	288	0	0
(4) Fieldman, one, @ Rs. 25 per mensem ..	300	0	0
(5) Expert Mali for Green house, etc., one @ Rs. 30 ..	360	0	0
(6) Mechanic for pumping station, one @ Rs. 30 per mensem ..	360	0	0
(7) Bullockmen for feeding the bullocks, three, Rs. 15 per mensem ..	510	0	0
(8) Chankidars for the experimental plot for day and night duties, two, Rs. 15 per mensem ..	360	0	0
(9) Temporary labourers on average scale of four men a day, @ Rs. 12 per mensem ..	576	0	0
Total ..	3,152	0	0
Grand Total of recurring expenditure ..	61,277	0	0

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Summary.

			Rs.	A.	P.
1 Contribution of the Hindu University	8,20,000	0	0
2. Grant required from the Imperial Council of Agricultural Research—					
(a) Non-Recurring .. ..	..	..	4,15,184	0	0
(b) Recurring .. ..	..	..	61,277	0	0

ANNEXURE C.

Problems for Investigation : The Outlook and the Mode of Attack.

The improvement in the quality and quantity of the yield of some of the most important Indian crops will be our objective.

Out of the various economic crops we wish to concentrate our attention, for the present, on a careful and thorough study of the following crops :—

- (1) Sugar-Cane : The analysis of the factors (especially temperature, water requirements, soil aeration, development of root system in relation to the soil) determining the storage of sucrose in the cane and the ripening of sugar cane, *i.e.*, the attainment of a high sucrose content and juice purity.
- (2) Oil Seeds : The analysis of factors determining the formation of oils in the seeds at critical periods of their growth, leading to high yield.
- (3) Wheat : The analysis of the factors determining the yield, high grain quality with good milling and baking properties.
- (4) Cotton : The analysis of factors determining high yield and quality of fibre, and the shedding of bolls.

The economic importance of any contribution to our knowledge of the development of the above crops needs no comment as even a partial failure of these crops becomes a national calamity.

Two important aspects of the question have to be explored. The first is an adequate realisation of the working condition of the cultivator so that proposals for his benefit may be available from his point of view. The second is the need of a critical study of the problems on an experimental basis.

The first can be satisfied by *personal* experience of the rural area and its agricultural practice as also from the voluminous literature made available by the agricultural departments. To satisfy the second condition is the object of the present scheme.

The aspects of the problems that we wish to attack with respect to the above crops may be stated to be :—

- (1) The improvement of varieties.
- (2) Providing methods and finding means by rigorous experimentation for a successful cultivation of these varieties under various soil and climatic conditions, in order to get the maximum possible yield in quality and quantity with the minimum of cost and with methods simple enough to be used by the ordinary cultivator.

It is intended to begin the work with genetics. But the pronounced deterioration and the culminating catastrophic failure of the already fixed varieties call for a transition into the field of physiology to search in to the "How" and "In what manner". A routine amassing of data for Mendelian analysis will be taken up as a supplementary programme to the physiological inquiries held, since isolated genetical studies have failed to give a clue to the components themselves. The genetical and physiological aspects have to be harmonised to yield results of *practical* application.

It is hardly possible to lay one's finger on the *limiting factor* or *factors* of crop production by detached experimentation under the varying stress of conditions obtaining in nature, unless work in the field is carried on simultaneously under controlled conditions and a knowledge of the precise effect of individual conditioning factors and their interaction is available. Then and then alone, is it possible to make good the deficit wherever it lies.

It is, therefore, proposed to subject to a critical study the machinery of the above plants in general, beginning from the in-take of raw materials through root hairs in the shape of mineral solutions and through the green organs (in

the shape of root) to their final elaboration in the leaf as reserve material. The upward movement of the mineral solution, the nature and magnitude of the forces concerned in the rise, the distribution of the solutions in various organs in time and space will be traced next. A study of the chemical and biological processes occurring in the soil, in their relation to the absorption of mineral nutrients by the root hairs, will be undertaken with a view to their adaptation to practical ends.

Our further step will be to follow the ingress and egress of carbon-dioxide and oxygen till the former reaches the green corpuscles and is worked up to the different classes of materials by means of specific energy furnished from the sun.

Another problem will be tracing the physico-chemical reactions that follow the up-grade metabolism of carbohydrates, nitrogen, and fats depending upon the specific nature and the developmental stage of the plant.

How the translocation of the elaborated compounds is effected to the storage organs and other parts of activities and the forces governing such transference will be our next enquiry.

Successful agriculture realizes the maximum possibilities of plant growth. We will endeavour to understand the mechanism of growth by a quantitative analysis of its magnitude at successive phases of the life cycle of the plant, estimating that magnitude in terms of other cell activities which are believed to be contributory. We then propose to trace the graded intensity of the reactions accompanying diverse growth phenomena under differential conditions of external as well as internal factors.

Having thus gained an insight into the cell activities and the conditioning factor thereof, it is intended to subject the plant machinery to such chemical and physical stimuli at critical stages as to induce the maximum yield.

Another important inquiry will be tracing the release of energy through the breakdown of elaborated food material, with special reference to the age of the plant, its developmental stage, the season in which it is growing, and the internal state of the protoplasm, for building up its own body and for the subsequent manufacture of reserve food materials generally stored in the seed for the use of the next generation. In order to get the maximum output of the plant machinery it is essential that the growth potential of the young plant during the early stages be so accelerated as to subsequently induce enhanced efficiency for building up its own body. We wish, therefore, to lay more stress on the early phase of the plant life when it is embarking on its life journey. After all growth depends upon the "initial capital". It is not however, 'the initial capital alone that will determine the subsequent growth potential', but the way in which the "ball of capital" is set rolling and the subsequent rate of its progression in the shape of division of undifferentiated meristematic tissue.

We would then investigate the energy relation of the growing plant in its dimensional aspect, the attempt being to estimate the efficiency of different crop plants in utilizing and transforming solar energy for work of different kinds throughout the life cycle. Apart from the proportion of energy expended during the up-grade processes, its expenditure in keeping up the "water balance" of the plant will be thoroughly investigated for a real insight into the "water requirements" of crop plants. In short, we propose to prepare a complete *energy balance sheet* for the whole plant under various conditions for improving the final yield. We further wish to determine the total amount of solar radiation falling on a cultivated area and the amount utilized by different kinds of crops for the production of the final yield.

As a practical measure, the results obtained after this long and continued enquiry, will be used for provoking new vital characters in the plant in order to have more rapid photosynthesis and to produce material of high caloric value relatively rapidly.

ANNEXURE D.

CONTRIBUTIONS FROM THE PLANT PHYSIOLOGY SECTION.

Benares Hindu University.

I. The Growth of the Cotton Plant in India.

- (1) Inamdar, R. S., Singh, S. B., and Pande, T. D. "The Relative Growth-Rates during Successive Periods of Growth and the Relation between Growth-rate and Respiratory Index throughout the life-cycle, Ann. of Bot., Vol. XXXIX, No. CLIV, April, 1925."
- (2) Inamdar, R. S. and Singh, B. N. "The predetermination of Subsequent Growth Variability and variation in the Growth Resistance Potential at the early Seedling Phase and its explanation in terms of External Factors (temperature) and internal conditions (Hydration of growing tissues) Proc. Seventeenth Ind. Sc. Cong., Agricultural Sec. Allahabad, 1930."
- (3) Inamdar, R. S. and Singh, B. N. "The relation of Reproductive Growth to Vegetative Growth as judged by the Growth Curves in *Dhulia neglectum*: The Physiological significance of maximal humps in Growth-rate Curves antecedent to successive initiation of Reproductive Growth, Proc. Seventeenth Ind. Sc. Cong. Agricultural Sec. Allahabad, 1930."
- (4) Inamdar, R. S. and Singh, B. N. "The Interpretation of varietal variability of Growth in *Gossypium herbaceum* as compared with that of *Dhulia neglectum*, Proc. Seventeenth Ind. Sc. Cong., Agricultural Sec. Allahabad, 1930."
- (5) Singh, B. N. .. "The Causal Factors at work in the shedding of Flowers and Bolls (which determine the final yield in Cotton) in terms of the conceptions of Dynamic Equilibria in the Co-ordinated Growth activity of the entire organism in successive phases of Growth, Proc. Seventeenth Ind. Sc. Cong., Agricultural Sec. Allahabad, 1930."
- (6) Inamdar, R. S. and Singh, B. N. "Growth Energetics of the Mustard Plant. (unpublished) 1926."

II. Studies in Growth, Senescence and Rejuvenescence in Plants.

- (7) Singh, B. N. .. "The Metabolic Basis of Growth, Senescence and Rejuvenescence in Plants, Thesis accepted for the Degree of Doctor of Science, B. H. U., 1927."

- (8) Singh, B. N. "A comparative study of the Respiratory Index, Water-Content, and the Rate of Healing of Mechanical Wounds in *Hibiscus esculentus*, Journ. Ind. Bot. Soc. 7, pp. 17—21, 1928."
- (9) Singh, B. N. "On the Intrinsic Potentiality of Growth : Ontogenetic Drifts in the Respiratory Index of the Meristematic Tissues in a population of Crop Plants : Hydration Factor in Respiration and Growth. Proc. Ind. Sc. Cong., Allahabad, 1930."
- (10) Singh, B. N. "Studies in the Growth of Annual Plants as measured by the external organ dimensions (unpublished), 1927."
- (11) Singh, B. N. "The Behaviour of the Aerobic and Anaerobic Respirations and their Ratio throughout the Ontogeny of Foliage leaves of the Mustard Plant, with Special reference to Growth (unpublished), 1926."
- (12) Singh, B. N. and V. V. Apte .. "A Comparative Study of the Growth Rates and Respiration throughout the Life-cycle of the Radish Plant during successive periods of Growth in relation to Leaf-area and Leaf-weight Ratio Proc. Fourteenth Ind. Sc. Cong., Lahore, 1927."
- (13) Singh, B. N. and V. V. Apte .. "Seasonal variations in the Growth Rate and Respiration in relation to Leaf-area and Leaf-weight Ratios throughout the Life-cycle of the Radish Plant Proc. Fourteenth Ind. Sc. Cong., Lahore, 1927."
- (14) Kumar, K. "The Relative Distribution of Growth and Growth Materials in the whole Plant and its parts at successive Stages of Growth in the Long Beans. Proc. Seventeenth Ind. Sc. Cong., Allahabad, 1930."
- (15) Shrivastava, A. L. "The Factors Concerned in the Relative Sizes attained by the Shoot and the Root in Herbaceous Plants, Proc. Seventeenth Ind. Sc. Cong., Allahabad, 1930."
- III. Determination of Seed Potentiality Leading to Subsequent Growth and Yield in Crop Plants.*
- (16) Inamdar, R. S. and Singh, B. N. "Effect of previous Temperature on the respiration of Germinating wheat grains Proc. Twelfth Ind. Sc. Cong., Benares, 1925."
- (17) Singh, B. N. and Kumar, K. .. "The Influence of the Size and weight of the seed on the Growth Potential and the Final Yield as applied to Agriculture, Proc. Seventeenth Ind. Sc. Cong., Allahabad, 1930."

IV. Studies in the Storage of Fruits in India.

- (18) Singh, B. N. "The Mechanism of Respiration in Fleshy Plant Organs which offer great Organisational Resistance to the Exchange of gases, and store a large stock of Carbohydrate reserves; An analysis of the Respiratory Drift in Air and Nitrogen and their Ratios $\Delta n/\Delta t$ at different temperatures, as also the 'Air-Nitrogen' and 'Nitrogen-Air', After-effects in Oranges, Proc. Seventeenth Ind. Sc. Cong., Bot. Sec., Allahabad, 1930."
- (19) Singh, B. N. "The Mechanism of Respiration in Fleshy Plant Organs which offer great Organisational Resistance to the Exchange of Gases, and store a large stock of carbohydrate Reserves: Localisation of a shift in the working of the Respiratory system with the march of Age in Knol Kohl Tubers, Proc. Seventeenth Ind. Sc. Cong., Bot. Sec., Allahabad, 1930."
- (20) Singh, B. N. "Proposal of a Scheme for the Dynamic Systems involved in the Respiration of Oranges and Knol Kohl Tubers, Proc. Ind. Sc. Cong., Bot. Sec., Allahabad, 1930."
- (21) Singh, B. N. "Studies on the Effect of Previous Temperature on the Rates of Respiration in Green Lemons 1926. (To be communicated)."

V. Water Balance in Tropical Plants.

- (22) Inamdar, R. S. "The Water Balance in Different Stages of Growth in the Mustard Plant, Proc. Ind. Sc. Cong., Bot. Sec., Allahabad, 1930."
- (23) Inamdar, R. S. and Singh, B. N. "Hourly variations in the water-Content of the Rapidly Transpiring Leaves of Jasamine during the Summer months Proc. Twelfth Ind. Sc. Cong., Bot. Sec., Benares, 1925."
- (24) Singh, B. N. "On the use of the Bares Evaporimeter, and Evaporimeters in general in Studies on Plant Transpiration, especially in the open air. Journ. Ind. Bot. Soc. pp 149-170, 1924. Bot. Gaz. Vol. 79, pp. 343-344, 1925; Bot. Abstracts. 6193, number VII July 1925; Physiological Abstracts Vol. X Number 10, pp. 551-552, 1926; Botanische Centralblatt, 1925,"

- (25) Inamdar, R. S. and Shrivastava A. L. "Seasonal Variations in Specific Conductivity of Wood in Tropical Plants with reference to Leaf-fall, Bot. Gaz. Vid. LXXXIII, No. 1, March, 1927."
- (26) "The Relation between the Specific Conductivity and the Structure of the Wood Elements in the Tropical Plants Journ. Ind. Bot. Soc., Vol. IV, No. 9 and 20, 1925."
- (27) Inamdar, R. S. and Verma, S. S. "Seasonal Variation in the Transpiring Power and the Specific Conductivity in *Tagetes latifolia*, Proc. Twelfth Ind. Sc. Congress, Bombay, 1925."
- (28) Inamdar, R. S. and Dubey, B. M. "The Daily Equivalence of Transpiration Loss of water under varying Intensities of Atmospheric Conductivity, Proc. Seventeenth Ind. Sc. Congr., Pat. Sec., Allahabad, 1930."
- (29) Singh, B. N. and Pandey, M. M. "The Mechanism of Xerophylls in Plant, 1929, (to be communicated)."

VI Leaf Stomata.

- (30) Inamdar, R. S. and Kumar, K. "The Absorption of CO_2 by Potash Solution with reference to the Relation of Assimilation to CO_2 concentration, Proc. Thirtieth Ind. Sc. Congress, Bot. Sec. Bombay, 1926."

VII Assimilation of Carbon.

- (31) Inamdar, R. S. "Optimum and Limiting factor in Assimilation of CO_2 , Proc. Ind. Sc. Congr. Lucknow."
- (32) Singh, B. N. and Kumar, K. "Ontogenetic Drifts in the Photosynthetic Activity of the Petiole Leaves of the Radish Plant, Proc. Fourteenth Ind. Sc. Congr., Bot. Sec., 1927, Lahore."
- (33) Singh, B. N. and Taneja, R. "What is the First Sugar Formed during Photosynthesis?, (to be communicated), 1927."

VIII Studies in the Respiration of Tropical Plants.

- (34) Inamdar, R. S. and Sin, L. B. N. "Seasonal Variations in Aerobic and Anaerobic Respiration in the Leaves of *Artocarpus integrifolia*, Journ. Ind. Bot. Soc. Vol. VI, No. 3 and 4, 1927, pp. 134-210, Proc. Thirtieth Ind. Sc. Congress, Bombay, 1926."
- (35) Singh, B. N. "Studies in the Mechanism of Respiration in plants, Thesis accepted for the D. Sc. degree, D. H. U. 1927."
- (36) Inamdar, R. S. and Singh, B. N. "Effect of Temperature on Aerobic and Anaerobic Respiration and their ratios in the Leaves of *Eugenia jambolana*, Proc. Twelfth Ind. Sc. Congress, Bangalore, 1924."

- (37) Inamdar, R. S. and Singh, B. N. "Effect of Temperature on the ratio of the Rates of Aerobic and Anaerobic Respirations in the Leaves of *Artocarpus Integrifolia*," Proc. Eleventh Ind. Sc. Cong., Bot. Sec., Bangalore, 1924."
- (38) Singh, B. N. .. "A search into the Nature of the Sugar Substrata in Respiration : Effect of different Sugars on Respiration of the *Artocarpus integrifolia* leaves, Proc. Seventeenth Ind. Sc. Cong., Bot. Sec., 1930, Allahabad."
- (39) Singh, B. N. .. "Effect of Chemical Stimuli on Respiration, unpublished, 1926."
- (40) Singh, B. N. and Varadpande, K. V. "Effect of Injecting Water, Glucose and Phosphates on a Failing System of Respiration in the *Artocarpus Integrifolia* leaves, and its Significance on the Mechanism of Respiration, Proc., Seventeenth Ind. Sc. Cong., Bot. Sec., Allahabad, 1930."
- (41) Inamdar, R. S. and Varadpande, K. V. "A Glucose Effect on the Permeability of Cell Membrane to Sugar Molecules, Journ. Ind. Bot. Sec. Vol. VIII, No. 3, Nov. 1929 ; Proc. Ind. Sc. Cong., Bot. Sec. Allahabad, 1930."

IX. Researches on the Chemistry and Physiology of Tropical Plants.

- (42) Singh, B. N., Singh, B. and Singh, T. S. N. "A Critical Study of the Carbohydrate Analysis in Plant Organs, Proc. Fourteenth Ind. Sc. Cong., Bot. Sec., Lahore, 1927."
- (43) —————, .. "The Role of the Carbohydrate-Nitrogen Balance throughout the Ontogeny of the Radish Plant, Proc. Fourteenth Ind. Sc. Cong., Botany Sec., Lahore, 1927."

X. Analytic Studies on the Transport of Carbohydrates in Plants of Economic Importance.

- (44) Singh, B. N., Singh, B., and Singh, T. S. N. "Transport of the Carbohydrate Substances in the *Artocarpus integrifolia*. Plant in different seasons and under varying stresses, 1927, to be communicated."

XI. Analytic Studies on the Transport of Nitrogenous Substances in Plants of Economic Importance.

- (45) Singh, B. N. Prasad, K. and Pande, R. N. "Analytical Studies into the Dynamics of Carbohydrate-Nitrogen Flux in the Vegetative and Reproductive Organs of *Artocarpus integrifolia*, Proc. Ind. Sc. Cong., Bot. Sec. 1930 Allahabad."

VII. *General Physiology, Addresses, Papers and Comments.*

- (43) Inamdar, R. S. "The Assimilation of Physiological
Processes in Plants, Presidential
Address, Botany Sec, Twelfth Ind.
Sci Cong., Benares, 1925."
- (47) —————, "The Law of Formants and the Law
of Product in Physiology, Journ.
Ind. Bot. Soc, Nov., 1921"
- (48) —————, "Inference in Exact Data, a Review of
Prof. Puri's Article on the
subject, Journ Ind Bot. Soc,
1921"
- (49) —————, "The Functional Decay of Leaves"
R. H. Dutt: A few critical
remarks, Journ Ind. Bot. Soc, Vol.
IV, Nos 9 and 10, 1925"
- (50) —————, "The Age of the Earth, Presidential
Address, Scientific Society, Benares
Hindu University, B. H. U.
Meerut, 1924"

VIII. *Ecology and Plant Growth.*

- (51) Shrivastava, A. L. "Ecology of the Flora of Benares,
Pt. I. Proc Seventeenth Ind. Sci
Cong., Allahabad, 1930."

ANNEXURE E.

List of Scholars who have taken the Degrees of Doctor of Science and of Master of Science from the Benares Hindu University.

DOCTOR OF SCIENCE.

Name.	Placed in Division.	Year of taking the degree.	How employed.
1. Dr. B. N. Singh, M.Sc., D.Sc.	..	1926	Asst. Professor of Plant Physiology, Benares Hindu University.

MASTER OF SCIENCE.

1. Mr. C. Krishnamurthy, M.Sc.	.. III	1921	Asst. Professor of Botany, St. John's College, Agra.
2. The late Mr. H. C. Ahuja, M.Sc.	.. II	1921	Late Asst. Professor of Botany, Benares Hindu University.
3. Mr. R. K. Saksena, M.Sc.	.. II	1922	Lecturer in Botany, University of Allahabad.
4. Mr. S. Ranjan, M.Sc.	.. II	1923	Reader in Botany, University of Allahabad.
5. Mr. R. Ahmad, M.Sc.	.. I	1923	Lecturer in Botany, Aligarh University.
6. Mr. S. P. Naithani, M.Sc.	.. III	1923	Demonstrator in Botany, University of Allahabad.
7. Dr. B. N. Singh, M.Sc., D.Sc.	.. I	1924	Asst. Professor of Plant Physiology, Benares Hindu University.
8. Dr. S. B. Singh, M.Sc., Ph.D.	.. I	1924	Assistant Deputy Director of Agriculture, U. P.
9. Mr. B. M. Dabial, M.Sc.	.. I	1924	Physiological Botanist, Agricultural Research Station, Sakrand (Sindh).
10. Mr. Akshayhar Lal, M.Sc.	.. II	1924	Demonstrator in Botany, Benares Hindu University, Formerly Demonstrator in Botany, Allahabad University.
11. Mr. T. D. Pandey, M.Sc.	.. II	1924	Accountant General's Office, Allahabad, formerly Demonstrator in Botany, Benares Hindu University.
12. Mr. S. Varma, M.Sc.	.. II	1925	Research Scholar, Indian Central Cotton Committee.
13. Mr. Krishna Kumar, M.Sc.	.. II	1925	Demonstrator in Botany, Benares Hindu University.
14. Mr. S. S. Rane, M.Sc.	.. II	1926	Research Scholar, Indian Central Cotton Committee, Indore.

- 15 Mr. K. V. Varadpandey, M.Sc. .. I 1927 Assistant Professor of Botany,
Science College, Nagpur.
- 16 Mr. Balwant Singh, M.Sc. .. II 1927 Lecturer in Medical Botany,
Benares Hindu University.
- 17 Mr. V. V. Apte, M.Sc. .. II 1927 Assistant Professor of Botany,
Royal Institute of Science,
Bombay.
- 18 Mr. T. S. N. Singh, B.Sc. .. 1927 Scientific Assistant, Sugarcane
Research Station, Coimbatore.
- 19 Mr. M. M. Sudama, M.Sc. .. III 1929 Asst. Professor of Biology,
Holkar College, Nagpur.
- 20 Mr. S. S. Rana, M.Sc. .. II 1929 Asst. Professor of Biology,
Jawahar College, Srirangapatna,
Karnataka.
- 21 Mr. Ram Arayan Tripathi, M.Sc. .. III 1929 Candidate for the Bihar and
Orissa Agricultural Service.
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NON-RECURRING.

ANNEXURE F.

ADDITIONAL RESEARCH APPARATUS.

(i) Seed Testing and Germination.

Articles.	No.	Price.		
		Rs.	s.	p.
Incubator for seed testing	1	460	0	0
Germinators	1	275	0	0
Seed Germinating Apparatus	1	50	0	0
Disphandoscope	1	185	0	0
Corn Sampler	1	50	0	0
Apparatus for measuring single seeds ..	1	160	0	0
Filter papers for germination	1	20	0	0
Wooden germinating boxes .. ..	..	100	0	0
Culture bottles complete with aerating device of various sizes .. ..	..	600	0	0
Total ..	..	1,850	0	0

(ii) Assimilation.

Sand Time Glasses	3	45	0	0
Hasse's, apparatus for determination of CO_2 in air	2	12	0	0
Jolly's apparatus for determination of O_2 in air .. ..	..	80	0	0
Acropylene cloth for field assimilation and respiration experiments .. ..	..	50	0	0
Blackman's commutators both (for field and laboratory work)	2	650	0	0
Compensation balance with self-recorder ..	..	875	0	0
Peltonkoffer tubes	6 doz.	216	0	0
Aspirator, copper, 80 litres cap.	4	600	0	0
Air catchers for aspirator	2	80	0	0
Droppers	1	86	0	0
Special calcium chloride bulbs	2	75	0	0
Special electric clock	1	500	0	0
Assimilation chambers both for Lab. and field of various sizes	1 doz.	200	0	0
Electric lamps of high intensity with holders	6	100	0	0
Electric pump to supply gas at high pressure in assimilation experiments	1	300	0	0
Titration gasometer	1	50	0	0
Special stock solution bottles for KOH , Ba (OH^2) HCl and water	8	800	0	0
Potash towers	6	120	0	0
Potash absorption apparatus	1	100	0	0
Glass filter for absorbing heat rays	2	200	0	0
Marble tower for generating CO_2	6	120	0	0
Warburg's apparatus for assimilation as modified by Haldane and Barcroft	1	100	0	0
Sporlu's automatic assimilation apparatus	1	600	0	0
Rose's apparatus for absorption of CO_2 under field conditions	2	200	0	0
Pipette droppers	2 doz.	24	0	0
Aspirator droppers	2	24	0	0
Total ..	..	5,037	0	0

(III) Respiration

Articles.	No.	Price.		
		Rs.	a.	p.
Mercury air pump for gas analysis in respiration .. .. .	..	300	0	0
Auto Colog recorder .. .. .	..	600	0	0
Apparatus for circulating gas in closed system .. .. .	..	15	0	0
Bonnier and Mangin apparatus for respiration experiments .. .. .	..	225	0	0
Water graduated tubes for above	2	200	0	0
Wulff's gas absorption pipettes	3	51	0	0
Unilinder portable durometer CO_2 testing apparatus	1	64	0	0
Petersch apparatus for determining respiratory coefficient with extra bottles	1	77	0	0
Hempel's bottle with platinum for use for direct determination of respiratory coefficient, complete with holder, etc.	2	150	0	0
Barrel gas holder for supplying different percentage of O_2	2	500	0	0
Total .. .. .	..	1,312	0	0

(iv) Water Balance.

Special Apparatus for determining transpiration of water from leaves, exposure to light and soil under net light	1	700	0	0
Autopneumometer and continuous recording holder for studies of transpiration, translocation, sedimentation, fluorescence, etc.	1	5700	0	0
Horizontal dishes for evaporation and transpiration (Machereux type)	1	275	0	0
Metal pans for transpiration, different sizes of the specially prepared	2 doz.	500	0	0
Stone vessels (one litre) for work on evaporation of liquid and solid substances (to be specially prepared)	2 "	500	0	0
Automatic platform balance (self-recording) for transpiration experiments	6	5,500	0	0
Special incubator for transpiration experiments under controlled conditions	1	12	0	0
Microscope (Leitz type)	20 lvs.	60	0	0
Microscope, Leitz type .. .. .	..	..	..	..
Special glass plates and brass covers for incubator .. .. .	..	..	..	..
Special glass plates, in transpiration experiments	4 doz.	150	0	0
Incubated by container	2 "	120	0	0
Special wood and saw dust incubator for pots (to be locally prepared)	1	300	0	0
Special apparatus to find out internal temp. of plant organs for energy relation experiments .. .. .	..	3,000	0	0

Articles.	No.	Price. Rs. a. p.
Prometer with self-recording device complete for measuring stomatal opening ..	1	270 0 0
Electric fan for transpiration experiments	2	234 0 0
Apparatus for specific conductivity of wood, complete	1	415 0 0
Apparatus to determine wilting co-efficient complete with motor	1	200 0 0
Baratzky's apparatus for automatic regis- tration of cell sap	1	225 0 0
Total ..		14,439 0 0

(v) Growth.

Auxograph to record variations in thickness of leaf under definite conditions ..	..	225 0 0
Auxograph for recording thickness of vege- tative organs .. ..	..	178 0 0
Auxograph for measurement of length ..	..	250 0 0
Culture vessels of various sizes ..	..	600 0 0
Green house for experiment on growth	} ..	Refer to experimental Farm Section.
Hot House		
Experimental Farm		
Total ..		1,253 0 0

(vi) Soil Analysis.

Soil Sampler	3	95 0 0
Heavy iron collar for driving, for above ..	3	7 6 0
Soil sample tins, Cap—		
20z.	3 doz.	10 6 0
40z.	3 "	11 8 0
80z.	3 "	12 0 0
Carrying tins, to take 24 tins, 4 sizes each ..	1	32 0 0
Earth borer, Frankel's pattern, for taking samples of earth from a depth 2 metres long	3	150 0 0
Sieves, brass standard mesh	1 set	160 0 0
Sieves, for soil analysis of 6" diam. ..	1 "	200 0 0
Wagener's shaking apparatus for the estima- tion of phosphoric acid with motor ..	1	530 0 0
Shaking machine for sieves	1	450 0 0
Jars with spout for sedimentation test diffe- rent cap.	1 doz.	30 0 0
Ditto graduated	1 "	68 0 0
Centrifuge for determining moisture equiva- lents	1	1,050 0 0
Automatic and continuous recording balance ..	1	2,525 0 0
Earth Thermometer, Symon's pattern ..	1	550 0 0
Apparatus for measuring the pH of solid complete	1	1,125 0 0
Hot bed thermometers	6	60 0 0

Articles.	No.	Price.		
		Rs.	a.	p.
Heat absorption apparatus	1	40	0	0
Heat conductivity apparatus	1	75	0	0
Soil Boxes	12	85	0	0
Soil aspirator	1	40	0	0
Hcinrich's apparatus for determining permeability in open field	1	40	0	0
Apparatus for estimating the capillary action of soil	1	125	0	0
Spare tubes set of	10	120	0	0
Apparatus for collecting soil air	1	80	0	0
Mortar with wooden pestle	3	10	0	0
Whatman's filter paper No. 1 in packets of 100	12 pkts.	24	0	0
Stoppered measuring cylinder liter cap	1	32	0	0
Pipette 20ml. with cylinder stem and cork to fit the neck of cylinder	12	30	0	0
Vitr. dish.	1 doz.	40	0	0
Muffle furnace, gas heated	1	120	0	0
Rubber pestle	2	17	0	0
Wegner's sedimentation tube	1	42	0	0
Soil washing apparatus	1	61	0	0
Hall and Russel carbonate determination apparatus	1	60	0	0
Mathews app for ammonia determination	1	75	0	0
Sharples super centrifuge for colloid investigation	1	30	0	0
Apparatus for measuring changes in soil vol.	1	60	0	0
Evaporimeter	1	48	0	0
Haldans apparatus	1 set	150	0	0
Mineral analysis soluble salt content electrical conductivity apparatus (See special app.) .. ..	..	..	..	..
Microscopical examination (See Microscopy) .. ..	..	..	..	..
Total .. ..	..	7,362	0	0

(vii) Balances and Weights.

Balance (ordinary) for the chemical store	1	40	0	0
Balance, analytical	1	300	0	0
Balance, Sartorius No. 3 for analytical work	1	500	0	0
Weight box for above	1 set	105	0	0
Weight boxes, Analytical	2 sets	100	0	0
Weight box Ordinary	1 set	10	0	0
Weights, fractional	3 sets	15	0	0
Riders, extra	5	6	0	0
Pound weight	1 set	21	0	0
Angled desiccators for balances	12	12	0	0
Spring Balance	2	20	0	0
Balance, counter cap. 10 lbs.	1	90	0	0

Articles.	No.	Price		
		Rs.	a.	p.
Balance, counter with open pans (for assimilation experiments)	2	220	0	0
Weighing machine to weigh 24 tons	1	150	0	0
Automatic recording balance for Transpiration and Evaporation experiments of the type used by Briggs and Santz. (see Journ. Agri. Res. Vol. V., No. 14, 1916)	(See transpiration.)	..	..	..
Spirit level	2	5	0	0
Total .. .. .	..	1,592	0	0

(viii) Electrical Instruments and Other Goods.

Rheostat and battery charging board complete	1	90	0	0
Voltmeter 2 range	2	34	0	0
Ammeter	2	50	0	0
Sliding rheostat, different range	6	180	0	0
Terminals and connectors, various types	6	38	0	0
Electrical wires thin insulated bobbins (copper)	6	42	0	0
German silver	2 bobbins.	30	0	0
Flexible wires	200 yds.	70	0	0
Universal switch with sliding rheostat 25 to 5 amps. for experimental work	1	225	0	0
Set of Daniells cells of six	1 set	50	0	0
Accumulators of 6 volts	6	900	0	0
Simens Inert dry cells	1 doz.	5	0	0
Airtite	0	9	0	0
Electrometric titration app. complete	1	1,020	0	0
Weston standard cell	1	200	0	0
Thermo-couples, rare metal and other types with small range recording outfit	1 set	750	0	0
Triple Range Voltmeter	1	150	0	0
Mirror galvanometer	1	300	0	0
Galvanometer lamp and Scale	1	80	0	0
Commutators	6	150	0	0
Electric temperature regulator complete	1	250	0	0
Eudiometer	1	30	0	0
Induction coils	6	300	0	0
Voltmeter for the electrolysis of solutions	1	37	0	0
Electrometric chemical analysis apparatus .. .. .	..	..	..	..
Resistance Box	1	125	0	0
Lamp Resistances	2	150	0	0
Wheatstone Bridge	1	57	0	0
Ammeter and Voltmeter combined	1	20	0	0
Total .. .. .	..	5,289	0	0

(ix) Meteorological Apparatus.

Articles.	No.	Price.		
		Rs.	a.	p.
Self recording rain gauge	1	300	0	0
Maximum and minimum thermometer (six's)	1	15	0	0
Earth thermometers—				
1 foot	2	54	0	0
2 feet	1	32	0	0
4 feet	1	35	0	0
10 feet	1	45	0	0
Solar radiation thermometer	2	45	0	0
Thermo-Hygrograph	1	460	0	0
Wet and dry bulb thermometer	2	84	0	0
Horticultural hygrometer	1	32	0	0
Pickering standard evaporimeter	1	36	0	0
Barometer, standard	1	386	0	0
Anemometer	1	315	0	0
Total ..		1,845	0	0

E. (x) Other Miscellaneous Special Research Apparatus for Cell Physiolog
Cell Chemistry, Cell Physics, etc.

Apparatus for the determination of Carbon and Hydrogen, Fritz. Pregl pattern ..	1	250	0	0
Duma's nitrogen determination apparatus ..	1	220	0	0
Micro Kjeldahl's apparatus ..	1	40	0	0
Kjeldahl's apparatus (set of 6) electrically heated	1	300	0	0
Do. .. single sets ..	3 sets	30	0	0
Calculating rule	1	20	0	0
Sliding calliper	1	10	0	0
Beckman's apparatus for determining				
osmotic pressure, freezing point ..	1	90	0	0
Do. .. boiling point ..	1	100	0	0
Abbe's Refractometer for the determination of moisture content of cell sap and sugar percentage				
Schiff's nitrometer	3	700	0	0
Schiff's nitrometer	3	55	0	0
Van Slyke's Amino nitrogen app.	1	100	0	0
Schmidt fat extractor	1 set	50	0	0
Extra glass parts	1 set	45	0	0
Van Slyke's Carbon dioxide determination in cell sap	1 set	750	0	0
Folin's fume absorber	4	24	0	0
Bomb Calorimeter for determination of heat in finding energy relationships ..	1	750	0	0
Comparator, Cole and Onslow	3	24	0	0
Polariscopes, Schmidt and Hainch with accessories for sugar estimation	1	2,500	0	0
Electrical conductivity apparatus				
Kohlrausch, universal bridge with accessories	1	450	0	0

Articles.	No.	Price.		
		Rs.	a.	p.
Hally's still for preparing pure distilled water for use in electrical conductivity experiments	1	100	0	0
Hydrogen-iron concentration outfit	1	1,140	0	0
Ultra-microscope outfit	1	828	0	0
Soxhlet-Newton extraction app. for preparing plant tissue for carbohydrate studies	2 sets	51	0	0
Ostwalds pipettes	1 doz.	26	0	0
Apparatus for quantitative determination of catalase	1			
Spectroscope	1	1,240	0	0
Gas leak indicators	1	75	0	0
Gas pressure gauge	1	45	0	0
Simple and compound absorption pipettes (Hemple's)	12	130	0	0
Hemple's explosion pipette	2	60	0	0
Hemple's gas Burette special research type	3	200	0	0
Nitrometer	1	200	0	0
Gas explosion burettes, special	3	112	0	0
Gas Holder	1	120	0	0
Gas holder 10 litre cap.	2	162	0	0
Gas Cylinders (Compressed) --				
Oxygen with cylinders	6	500	0	0
Nitrogen with cylinders	6	500	0	0
Carbon dioxide cylinders	3	200	0	0
Kipp's apparatus	6	150	0	0
Sulphuretted hydrogen apparatus	1	50	0	0
Stop watches	6	200	0	0
Stop clock	2	80	0	0
Metronomes	2	35	0	0
Syringes for injecting substances in fleshy plant organs	1	34	0	0
Paper cutter	1	5	0	0
Reichert-Wollny apparatus	2	32	0	0
Polenske's apparatus	2	48	0	0
Seimens ozone tubes and ozone generator	1 set	800	0	0
Vacuum pump for specific conductivity	1	200	0	0
Manometers	2	32	0	0
Soxhlet's extraction special outfit	1	510	0	0
A set of reagents for spectrum analysis	1 set	35	0	0
Mercury distillation apparatus	1	130	0	0
Mercury vapour lamps for ultraviolet rays		200	0	0
Gelatine's absorption film		250	0	0
Ultra-violet light apparatus		4,000	0	0
Recording drums	6	810	0	0
Electro-magnet pens	2	150	0	0
Glazed paper for drum	1,000	25	0	0
Total		13,845	0	0

ANNEXURE G.
ADDITIONAL PHYSIOLOGICAL INSTRUMENTS.

Apparatus for General Equipment.

(1) Workshop Tools.

Articles.	No.	Price.		
		Rs.	a.	p.
Workshop lathe	1	600	0	0
Workshop drill	1	330	0	0
Workshop bench	1	90	0	0
Tool cabinet	1	110	0	0
Files	24	10	0	0
Hack saw frames	2	6	0	0
Pliers	6	15	0	0
Metal chisels	12	18	0	0
Screw drivers	12	20	0	0
Shears for cutting metals	2	5	8	0
Mallets	1	3	0	0
Scissors	3 pairs	10	0	0
Anvil	2	22	0	0
Spanner (adjustable)	3	10	0	0
Vice (hand)	1	12	0	0
Vice (strong parallel jaws)	1	20	0	0
Metal sheets, etc., according to market rates .. .. .	..	100	0	0
I. R. sheeting cord, window glasses, card boards, clock springs, silk thread, etc. .. .. .	..	50	0	0
Fletchers soldering burner (self-fitting)	1	16	0	0
Breast drill	1	28	0	0
Brace carpenter with centre bits to suit	1	30	0	0
Soldering material of different kinds	1	7	0	0
Stove	1	10	0	0
Other workshop requirements .. .. .	..	100	0	0
Total		1,622	8	0

(2) Glass Blowing Accessories.

Blow pipes	6	8	0	0
Blow pipe with 2 stop cocks for glass blowing	1	225	0	0
Fletcher's chemical analysis set	1	65	0	0
Blow pipe bellows	1	50	0	0
Glass blower's tools	1 set	15	0	0
Charcoal blocks	1 doz.	1	0	0
Charcoal borer	1	2	0	0
Charcoal pastille holders	1 doz.	8	6	0
Platinum wire holders	6	8	0	0
Charcoal saw	1	1	0	0
Machinb for cutting glass tubings	1	35	0	0
Diamond pencil	1	16	0	0
Glass marking pencil	2	4	0	0
Pencils for writing on glass	1 doz.	4	0	0
Total		442	6	0

(3) Microscopy and Histology.

Articles.	No.	Price.		
		Rs.	a.	p.
Micro warm stage	1	40	0	0
Research Microscope and accessories (immersion oil, etc.)	1	1,500	0	0
Micro slide incubator with thermometer	1	60	0	0
Camera lucida for microdrawing	1	108	0	0
Ocular micrometer	1	40	0	0
Stage micrometer	1	12	0	0
Micrometer slide	2	70	0	0
Microphotographic Camera without microscope (Thomas)	1	1,560	0	0
Drawing Eyepiece	1	10	0	0
Microtome knives	2	60	0	0
Razors	6	18	0	0
Hone and Strops	3	60	0	0
Micro cover slips .. .. .	..	18	0	0
Slide white for research	10 gross	30	0	0
Slide noncorrosive	5	30	0	0
Micro-culture slide	50	15	0	0
Labels .. Micro .. .. .	..	10	0	0
Slide boxes .. .. .	..	30	0	0
Cover slips 8 oz. .. .. .	..	25	0	0
Cover slips rectangular 3 oz. .. .. .	..	15	0	0
Turn table	1	25	0	0
Pith elders .. .. .	..	12	0	0
Strop for microtome knife	1	25	0	0
Hand lens .. .. .	..	10	0	0
Eyepieces cross line micrometer	1	25	0	0
Paraffin of different melting point .. .. .	..	5	0	0
Chamois leather .. .. .	..	20	0	0
Drawing table .. .. .	..	200	0	0
Bell jars	2	25	0	0
Staining jars	1 doz.	90	0	0
Dissecting instrument set	8	8	0	0
Brushes .. .. .	..	0	0	0
Canada balsam bottles	6	3	0	0
India rubber tents .. .. .	..	36	0	0
Drop bottles	4 doz.	13	8	0
Cedar wood oil bottle	6	100	0	0
Specimen tubes	200	95	0	0
Paraffin embedding bath .. .. .	..	50	0	0
Wide mouth flat stoppered bottles for keeping slides and cover glasses .. .. .	..	100	0	0
Wide mouth bottles for preserving specimens .. .. .	..	..	..	..
Total .. .. .	..	5,122	0	0

B. (4) Thermostat, Regulators, Stirrers, Shaft, Motors, Centrifuge, etc.

Thermostat.

Lawry's electric thermostat	1	850	0	0
Thermostats, glass sided	3	525	0	0
Thermostats with 6 volts electric motor and stirrer	1	120	0	0

Articles.	No.	Price.
		Rs. a. p.
Gas-regulators Reicherts Muneke	12	185 0 0
Do. Lawry's	6	105 0 0

Stirring Apparatus:—

Shaft with motor and belt arrangement to be fitted on physiological working bench 12' long with 4 sets of grooved pulley wheels which can be fitted to any position	1	300 0 0
Stirring apparatus to be used with the shaft	4	150 0 0
Shaking apparatus	1	80 0 0
Motors of different H. P. for physiological work	2	180 0 0
Hot air motor gas heater	1	200 0 0

Centrifuges.

Centrifugal machine, Gerber's hand driven ..	1	50 0 0
Centrifuge, Gerber's electrically driven ..	1	225 0 0
Extra tubes, trays and corks .. ..	..	40 0 0
Electrically driven air pump for determination of specific conductivity of wood ..	..	300 0 0
Total ..	..	3,510 0 0

B. (5) Thermometers and Hydrometers.

Thermometers, chemical	3 doz.	150 0 0
Thermometers, Standard for Research	3 "	300 0 0
Thermometers special high temperature ..	3 "	25 0 0
Beckman's Thermometer	2	30 0 0
Beckman's Differential Thermometer	1	50 0 0
Thermometer magnifier	2	30 0 0
Normal Thermometer	3	40 0 0
Do. Wall	3	12 0 0
Do. for Refrigerators	2	32 0 0
Do. Steam	1	25 0 0
Do. Chemical	2	85 0 0
Do. Box wood scale	2	15 0 0
Do. maximum and minimum	2	40 0 0
Self-recording distance Thermometers ..	1	100 0 0
Steel-tube mercury dial thermometer	1	75 0 0
Hydrometers (low and high sets)	2 sets	125 0 0
Saccharometers	5	75 0 0
Spirit Hydrometers	3	35 0 0
Salinometers	1 set	20 0 0
Total ..	..	1,184 0 0

(6) Brushes, Stands, Tripods, Wire Gauge, Clay Triangles, etc.

Articles.	No.	Price.		
		Rs.	a.	p.
Test tube brushes	3 doz.	3	9	0
Burette brushes	6	3	0	0
Brushes with Bristle in the middle with adjustable cleaner	6 sets	3	8	0
Burette Mohr's clips small, medium and large	4 doz. each	35	0	0
Burette stands hard wood	8	24	0	0
The W. J. Burette stand	2	10	0	0
Titration set	1	28	0	0
Test tube holders	2 doz.	21	0	0
Test tube stands	1 doz.	36	0	0
Tripod stands	3 doz.	48	0	0
Wooden supports	6	120	0	0
Berzelius table support	12	150	0	0
Retort stands	48	480	0	0
Retort stand clamps	72	180	0	0
Retort rings	24	72	0	0
Boss heads	24	26	0	0
Beehive shelf	12	25	0	0
Combined funnel and burette stand	4	24	0	0
Condenser clamps	12	75	0	0
Funnel stand	24	125	0	0
Pipette stand (circular)	4	100	0	0
Tongs for crucibles	6	36	0	0
Mercury tong	1	35	0	0
Wire Gauge	48	50	0	0
Claypipe triangles	12	17	0	0
Total		1,730	1	0

(7) Furnaces, Burners, Ovens, Dessicators, Evaporating Baths, etc.

Hot air sterilizer 30 x 30 x 40 in.	1	250	0	0
Hot air sterilizers "big size. To be specially prepared 6' x 30" x 24" with shelves gas heated with temp. capsule for 100 degrees, 35 degrees, 57 degrees	1	1,200	0	0
Incubator, copper, felt covered. Size 26" x 30" x 24"	1	450	0	0
Refrigerator	1	875	0	0
Water Bath copper	6	100	0	0
Water Bath copper size 3' x 2' x 1' to be specially prepared for holding several flasks at a time for sugar and nitrogen estimation, etc., with stand and lamp complete	1	250	0	0
Sand Bath	1 doz.	2	0	0
Furnace, Bunce's with fire clay bricks; for combustion of Oxygen, etc., 24"	1	165	0	0
Aluminium evaporating Basins	6	18	0	0
Cast Iron deep evaporating pan cap. 6 gallons	1	30	0	0

Articles.	No.	Price, Rs. a. p.
Bunsen burner with tube and air regulator of brass 7-16" diam.	1 doz.	355 0 0
Fittings for Bunsen Burners 7-16" diam.	1 set	10 0 0
	each.	
Burner, (Teclu Patten)	12	75 0 0
Fletchers Bunsen safety burner 1½" diam. ..	6	65 0 0
Fish tail burner	3	10 0 0
Furnace Burner	6	22 0 0
Standard boiling ring Burner 12" diam. ..	1	30 0 0
Do, 10"	2	40 0 0
High temperature burner size 3 and 4 ..	1	
	each.	
Micro Burners	6	20 0 0
		12 0 0
Total ..		3,979 0 0

B. (8) Stills and Condensers.

Condenser, Liebig's	1 doz.	80 0 0
Condensers, Liebig's (shortened type) ..	3 only	30 0 0
Condensers Spiral	3	75 0 0
Condensers Allihn's	3	30 0 0
Condensers Liebig's (copper body) ..	1	40 0 0
Mercury purifying apparatus	1	35 0 0
Automatic distillation still by gas ..	1	245 0 0
Condenser stand	6	100 0 0
Fractional distillation tubes	2	35 0 0
Receiver for fractional distillation ..	2	65 0 0
Total ..		735 0 0

(9) Grinding Mills, Press, Mortar and Pestle

Grinding Motor	1	80 0 0
Grinding Chopper	1	65 0 0
Sugar-cane crusher	1	200 0 0
Mortar and Pestle—		
Iron	2	60 0 0
Glass	3	30 0 0
Total ..		435 0 0

(10) Rubber Goods and Corks, etc.

I. R. Tubing best red quality bore 1, 1½, 1¾, 3/16, 1, 5/16, 3/8	30 each.	62 0 0
I. R. Tubing best red quality bore 1, 3/8, 1, 7/8	15 "	60 0 0
I. R. Tubing best red quality bore 1" ..	15 "	45 0 0
I. R. Tubing best red pressure bore— 1 mm.	10 "	8 6 0

Articles.	No.	Price.
		Rs. a. p.
$\frac{1}{8} \times \frac{3}{8}$, $\frac{1}{8} \times \frac{1}{2}$, $3'16 \times \frac{1}{2}$, $3'16 \times \frac{5}{8}$..	45 each	50 0 0
3'16	15 "	21 0 0
for burners bore 2 $\frac{1}{2}$	80 "	80 0 0
U. R. Corks Bung form 3, 2 $\frac{1}{2}$, 2 $\frac{1}{2}$, 2 $\frac{1}{2}$ " ..	18 "	210 0 0
U. R. Corks Bung form 1 $\frac{1}{2}$, 1 $\frac{5}{8}$, $\frac{1}{2}$, 1 $\frac{3}{8}$, 1 $\frac{1}{4}$ " ..	3 doz. each.	200 0 0
1 $\frac{1}{8}$, 1 $\frac{7}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{1}{2}$ "	3 "	75 0 0
U. R. Corks long form 3'16, $\frac{1}{2}$, $\frac{3}{8}$, 7'16, $\frac{1}{2}$, 9'16, $\frac{5}{8}$, 11'16, $\frac{1}{2}$ "	3 "	85 0 0
U. R. Corks long form 13'16, $\frac{7}{8}$, 1, 1 $\frac{1}{8}$, 13'16, 1 $\frac{1}{2}$, 1 $\frac{1}{2}$, 1 $\frac{5}{8}$, 1 $\frac{7}{8}$, 1, 15'16, ..	1 "	232 0 0
I. R. Teat	2 doz.	2 8 0
I. R. Caps.	2 "	5 0 0
I. R. Caps with lubulures	1 "	8 0 0
I. R. Tubes	1 "	8 0 0
I. R. Bands	4 boxes.	5 0 0
U. R. Sheets	3	0 0 0
U. R. Tents	12 oz.	6 0 0
I. R. Solution	$\frac{1}{2}$ lbs.	2 8 0
I. R. Charterton compound, in sticks ..	16 oz.	10 0 0
I. R. Circles for foot bellows	3	9 0 0
U. R. String net	2	7 0 0
Clips of various types	200	150 0 0
Corkrings	6	25 0 0
Knives for cutting corks	2	2 0 0
Cork borers	6	54 0 0
Cork squeezer	1	7 0 0
Cork borer sharpner	3	6 0 0
Cork boring machine	1	100 0 0
Pith corks of various sizes .. ..	..	30 0 0
Total ..	..	1,235 0 0

N. B.—This list includes—

(1) Non-recurring	635 0 0
(2) Recurring	600 0 0

(14) Filters.

Glass Filters for Analytical Work.

Buchner's Type	2	40 0 0
Buchner's Conical Type	3	12 0 0
Filter combined with Flask	3	15 0 0
Filter for working under pressure	3	30 0 0
Filter for Micro-Analysis	6	21 0 0
Gas Distributing Tube	6	21 0 0
Gas Washer	3	42 0 0
Potentiometric-Siphon	2	20 0 0
Soxhlet extraction app. with ointred Glass Filter	1	40 0 0
do. Thimble	2	10 0 0
do. Thimble Germ proof	6	55 0 0

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Articles.	No.	Price.
		Rs. a. p.
Filter tubes	1	2 0 0
Filter pump Flask	6	37 0 0
Dialyser	4	7 0 0
Filter pump with gauge	1	45 0 0
Filter pump glass	12	40 0 0
<i>Filter Papers and Extraction Thimbles.</i>		
Muencktem's 1F 2½ to 7½" diam.	4000	71 8 0
Muencktem's No. 0 2½ to 7½ diam.	1500	35 8 0
Post lip No. 633 2½, 4 to 15½" diam.	500	69 8 0
Folded circles of filter paper 12·5 to 50 mm.	1000	78 0 0
Filter paper case	6	100 0 0
Soxhlet's filter paper thimbles 10×50 to 26×60	60	20 0 6
Total ..		855 0 0

N. B.—This list includes—

(1) Initial non-recurring	530 0 0
(2) Recurring	325 0 0

(15) Glass and Stone Ware.

Wash Bottles	12 doz.	25 0 0
Erlenmeyer flask	2 "	20 0 0
Retorts	6 "	20 0 0
Basins with spout	6 "	6 0 0
Watch glass	10 "	120 0 0
Reagent bottles of various capacities	10	125 0 0
Laboratory glass tubings of different bores and thickness		100 0 0
Special monax glass blowing tubings		50 0 0
Glass rods		10 0 0
Capillary glass tubings		20 0 0
Culture flasks of different types		50 0 0
Automatic pipette	6	30 0 0
Y tubes	3 doz.	22 0 0
T tube	3 "	22 0 0
Y and T tubes with stop-cock	1 "	50 0 0
Stop-cocks 2 way straight bore	12	50 0 0
" oblique	12	48 0 0
" 3 way	12	70 0 0
" 2 way capillary	6	20 0 0
" 4 way	6	100 0 0
Combustion tubing		45 0 0
Weighing bottles	2 doz.	32 0 0
Woulf's bottles	2 "	150 0 0
Pneumatic Trough, round	1 "	100 0 0
Do. (Stone ware) of the above	1 "	150 0 0
Gas Jars	3 "	250 0 0
Glass funnels, plane of different sizes	4 "	50 0 0
Thistle funnel and Separating funnels	2 "	100 0 0
Glass boxes with and without holes for experimental physiology, various capacities	2 "	400 0 0

Articles.					No.	Price. Rs. a. p.		
Bottles narrow mouthed flat stoppered—								
4 ozs.	..	..	..	..	50	31	4	0
6 "	..	..	..	..	35	17	0	0
8 "	..	..	..	..	2 doz.	24	0	0
10 "	..	..	..	..	2 "	24	0	0
16 "	..	..	..	..	16 "	17	8	0
48 "	..	..	..	..	6 "	10	0	0
64 "	..	..	..	..	6	20	0	0
Bottles with extra wide neck—								
500 cc.	..	..	..	..	3 doz.	75	0	0
1000 cc.	..	..	..	..	2 "	100	0	0
Acid dishes—								
2 3/8" diam.	..	..	..	..	6	4	4	0
2 3/4" "	..	..	..	..	6	5	0	0
3 1/8" "	..	..	..	..	6	6	0	0
3 1/2" "	..	..	..	..	6	7	8	0
Bottle for dry salts, cap. —								
8 ozs.	..	..	..	..	1 doz.	14	0	0
12 "	..	..	..	..	6	8	0	0
20 "	..	..	..	..	6	10	8	0
Big bottles for stock solution various capacities								
..	..	..	..	..	1	100	0	0
Bottles with permanent labels 2 sets of 34 each								
..	..	..	..	..	..	100	0	0
Bottles, Gutta Percha 4 oz.								
..	..	..	..	..	1	4	0	0
Drop bottles cap. 30 cc.								
..	..	..	..	..	2 doz.	20	0	0
Drop bottles with rubber teats								
..	..	..	..	..	1 "	12	8	0
Dropping pipettes								
..	..	..	..	..	12	1	8	0
Glass aspirators various cap.								
..	..	..	..	..	1 doz.	240	0	0
Stone ware aspirators and bottles various capacities								
..	..	..	..	..	9	270	0	0
Bell Jars. Open at the top and flange at bottom—								
Height 7" 8" 9"	..	..	..	..	..	..	..	..
diam. 5" 5" 6"	..	..	..	..	3	52	8	0
Bell Jars. Open at top graduated into cc.—								
500 cc.	..	..	..	..	2	10	0	0
1000 cc.	..	..	..	..	1	30	0	0
2000 cc.	..	..	..	..	2			
Bell Jars. For covering instruments—								
Height.	Diam.	..	..	..	..	..	..	..
5"	5"	..	..	..	1	12	0	0
6"	6"	..	..	..	1	15	0	0
7"	6"	..	..	..	1	14	0	0
8"	10"	..	..	..	1	22	0	0
14"	14"	..	..	..	1	30	0	0
20"	20"	..	..	..	1	50	0	0

Articles.	No.	Price.
Rs. a. p.		
Calcium Chloride tubes "U" form, plane—		
Length. Diam.		
4" × 1"	12	5 0 0'
6 × 1"	12	7 0 0'
8 × 1"	6	7 0 0'
10 × 1"	6	7 4 0'
" with side tubes—		
4 × 1"	6	3 0 0'
8 × 1"	6	6 0 0'
" with 3 bulbs—		
8 × 1"	2	8 0 0'
Improved calcium chloride tubes with wall ground in bored stoppers and with bulb at bottom		
.. ..	2	8 0 0'
Calcium chloride bulbs	6	23 0 0'
Calcium chloride Jars, stoppered height, 16"	3	39 0 0'
Stands for supporting calcium chloride tubes		
.. ..	2	12 0 0'
Drying apparatus Bonn pattern	2	45 0 0'
Drying apparatus Berlin pattern	2	45 0 0'
Calcium chloride drying towers	6	30 0 0'
Stone ware bottles, cap. 6 gall.	4	70 0 0'
Mercury bottle " 10 lbs.	2	3 0 0'
Bung Jars. " 10 qts.	2	13 0 0'
Cooling snake (spirals)	4	64 0 0'
Stone ware taps	4	32 0 0'
Brass taps	2	8 12 0'
Glass taps	4	20 0 0'
Absorption tubes graduated	3	7 2 0'
Absorption tubes graduated of another kind	2	0 9 0'
Beakers, Squat form, Jena—		
150 cc.	1 doz.	20 8 8'
250 cc.	1 "	30 0 0'
400 cc.	1 "	43 0 0'
600 cc.	1 "	54 9 0'
800 cc.	1 "	42 0 0'
1000 cc.	1 "	50 0 0'
3000 cc.	1 "	72 0 0'
Beakers, tall form non-spout—		
25 cc.	2	7 6 0'
50 cc.	2	8 0 0'
150 cc.	2	10 3 0'
250 cc.	2	12 0 0'
400 cc.	2	14 6 0'
" Pyrex—		
250 cc.	2 doz.	27 0 0'
500 cc.	2 "	35 0 0'
Monax conical beakers—		
250 cc.	6	8 0 0'
400 cc.	6	8 0 0'
1000 cc.	1 doz.	6 1 0'

Articles.				No.	Price.		
					Rs.	a.	p.
Flasks resistance F. B.							
150—4000	..	..	..	3 doz.	180	0	0
Resistance Flasks R. S.							
250—300	..	..	..	3 doz.	60	0	0
Beaker Flasks—							
100 cc.	..	..	..	3	4	4	0
600 cc.	..	..	..	3	3	2	0
1000 cc.	..	..	..	3	10	0	0
Conical Flasks (R. G.)—							
175—1000 cc.	..	..	..	4 doz.	45	0	0
Distillation Flasks (R. G.)							
100—5000 cc.	..	..	..	9 doz.	163	0	0
Kjeldahl's Flasks (R. C.)—							
Short neck—							
300 cc.	..	..	..	6	7	0	0
500 cc.	..	..	..	3	4	4	0
Long neck—							
300 cc.	..	..	..	6	7	8	0
500 cc.	..	..	..	6	9	0	0
800 cc.	..	..	..	6	13	0	0
Pyrex—							
500 cc.	..	..	..	6	10	0	0
1000 cc.	..	..	..	4	20	0	0
Evaporating Basins (R. C.)—							
200 cc.	..	..	..	1 doz.	15	6	0
400 cc.	..	..	..	1 "	21	3	0
500 cc.	..	..	..	6	18	11	0
Crystallising—Dishes (R. G.)							
„ Non-spout 50—1000 cc...	..	..	..	3 doz.	30	0	0
„ with-spout—							
500 cc.	..	..	..	6	8	0	0
1000 cc.	..	..	..	6	16	0	0
Monax Co ₂ Flasks 250—500 cc.	..	..	..	1 doz.	12	0	0
Test tubes (Pyrex) 10×75 to 25×300	..	..	..	12 "	52	4	0
Pyrex copper determination flask 250 cc.	..	..	..	1 "	16	0	0
Pyrex Centrifuging Tubes—							
15 cc.	..	..	..	6	4	0	0
25 cc.	..	..	..	6	5	0	0
50 cc.	..	..	..	6	6	0	0
Pyrex Ignition Tubes—							
10×70	..	..	..	1 doz.	3	9	0
14×100	..	..	..	1 "	4	6	0
16×125	..	..	..	1 "	6	0	0
Burettes: with 3 way glass stop cock—							
50 cc.	..	..	..	3	20	0	0
100 cc.	..	..	..	2	10	0	0
Do. do but with							
white enamel back and blue line 50 cc.	..	..	..	4	00	0	0

Articles.	No.	Price.
		Rs. a. p.
Burettes with tube bent at right angles 50 cc.	2	9 2 0
Burettes (Cussler's) for volatile solution		
50 cc.	2	16 0 0
Anti-parallelax Cards	1 doz.	5 0 0
Pipettes, Bulb form with one mark on stem		
1 cc. to 100 cc.	3 doz.	20 0 0
Do. with safety bulb		
5 cc. to 100 cc.	2 doz.	20 0 0
Do. Plane 1 oz.	2	1 0 0
Do. Plane 2 oz.	2	1 8 0
Do. Graduated 1 cc.		
to 25 cc.	1 doz.	10 0 0
Measuring Cylinder, Tall form figured in both		
direction, divided into 100 div. 100 c. to		
1000 cc.	2 doz.	30 0 0
Do. Graduated in both English		
and Metric systems, 100—1000 cc. ..	5	28 0 0
Glass Jugs	6	8 4 0
Measuring Flasks, stoppered 25cc—2000 cc.	2 doz.	60 0 0
Standard Flasks, verified and stamped 500		
cc. to 1000 cc.	1½ doz.	175 0 0
Porcelain Basins, Royal Worcester—		
with spout—		
100 cc.	6	8 10 0
300 cc.	6	16 0 0
Deep form—		
200 cc.	3	9 0 0
500 cc.	3	14 0 0
Shallow form—		
150 cc.	3	7 4 0
200 cc.	3	9 2 0
Crucibles, R. W. 25 cc. to 140 cc. ..	3 doz.	42 8 0
Covers for above .. .. .	..	12 0 0
R. Worcester Porcelain 30 cc. to 1000 cc.	6	30 0 0
Do. Buchner Funnel—		
51 mm.	2	0 0 0
100 mm.	2	18 0 0
214 mm.	1	22 0 0
Do. Porcelain Funnel—		
52 mm.	1	2 9 0
77 mm.	1	4 3 0
130 mm.	1	8 6 0
R. W. Patent Funnel Buchner's Form—		
100 mm.	1	10 0 0
214 mm.	1	31 0 0
170 mm.	1	24 0 0
R. W. P. Spotting Plates	3	13 2 0
Do. Mercury Trough	3	21 5 0
Do. Combustion Tubes	2	35 9 0
Do. do. boats	5	9 0 0
Gooch.		
Gooch Crucibles with perforated bottom		
25 cc.	6	12 0 0
Mortar Pestles	8	36 0 0

Articles.			No.	Price.		
				Rs.	a.	p.
Nickel Triangles	..	..	6	5	0	0
„ Basins R. B.	..	..	6	23	8	0
„ Tongs	..	..	6	12	0	0
„ Spatulas	..	..	12	14	0	0
Vitreous Basin	..	..	1	4	4	0
do. Do. Crucibles	..	..	2	4	0	0
do. Do. flat	..	..	1	5	0	0
Quartz Combustion Tubes	..	..	2	80	0	0
Total				5,392	0	0

N. B.—This list includes—

(1) Non-recurring	..	..	..	4,042	0	0
(2) Recurring	..	..	..	1,350	0	0

ENCLOSURE II.

MINUTES OF THE 2ND MEETING OF THE UNITED PROVINCES
AGRICULTURAL RESEARCH COMMITTEE HELD ON JUNE THE
2ND, 1930, AT 11 A.M. AT THE CHALLI, NAINI TAL.

II. The Committee considered an application submitted by the Vice-Chancellor of the Benares Hindu University for a non-recurring grant of Rs. 4,15,181 and a recurring grant of Rs. 61,277 for a period of 5 years, for the University Institute of Agricultural Research (Appendix I).

The scheme was fully discussed in its application to agricultural research and research workers throughout India. The Committee was in full agreement with the creation of an Institute for research in plant physiology, but considered that the comprehensive scheme proposed for dealing with various branches of agricultural research would entail considerable overlapping with the research carried on by the Imperial and Provincial Departments of Agriculture, and by other institutions.

The Committee unanimously agreed to support the creation, at the Benares Hindu University, of a research Institute for plant physiology, specialising in the physiology of the metabolism of plants, but considered that as the proposed institute would carry on fundamental research applicable to the whole of India, and of equal importance to all the provinces, it was desirable that the scheme should be reported upon by a committee appointed by the Imperial Council of Agricultural Research.

The Committee was further unanimous in its opinion that capital provision sufficient to complete the buildings of the research laboratories should be made available during the current financial year, provided that the sub-committee of the Imperial Council of Agricultural Research reported favourably upon the All-India importance of the scheme.

It was considered advisable to defer detailed consideration of the estimates for laboratory equipment until the programme of work could be more specifically determined, and the question of capital expenditure on buildings had been settled. The following resolutions were passed by the Committee:—

Res. I (a).—“The Committee recommends the scheme for the establishment of an Institute of Agricultural Research at the Benares Hindu University, specialising in the physiology of the metabolism of plants.”

It wishes to emphasise that no provision exists for research in this subject in the Imperial Department of Agriculture, and either no provision or very limited provision exists in the provincial departments and provincial universities. The Benares Hindu University is, in the best sense, an All-India Institution drawing its workers and support from every part of India. It has a high record of achievement in this branch of work, and the Committee considers that it is well placed for development on the lines indicated above.

The Committee considers that the scheme is essentially an All-India and not a provincial scheme, and that this aspect should be thoroughly examined by an expert sub-committee appointed by the Advisory Board of the Imperial Council of Agricultural Research and tentatively suggest the following personnel:—

- (1) Mr. R. C. Barf, B.Sc., C.I.B., M.B.F., Agricultural Expert to the Imperial Council of Agricultural Research.
- (2) Dr. S. K. Mulergj, M.Sc., D.Sc. (London), F.L.S. (London), Professor of Botany, Lucknow University, Lucknow.

(3) Professor P. Parija, I.E.S., Professor of Botany, Ravenshaw College, Cuttack.

(4) Professor R. S. Inamdar, M.Sc., Botany Department, Benares Hindu University."

Res. 1 (b).—"Subject to the favourable report of the Sub-Committee suggested in Resolution 1 (a) above, the Committee recommends that in the first instance a grant of Rs. 1,65,000 should be made to the Benares Hindu University for the completion of the laboratory and fittings. Without this no progress can be made and the Committee suggests that a decision should be arrived at not later than the cold weather meeting of the Imperial Council 1930-31."

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APPENDIX XXXIII.

Statement showing the recommendations made in the Proceedings of the first meeting of the Fertilisers Committee held in June 1930, and the action taken thereon.

No	Page No. of Proceedings and item No. of Agenda.	Subject.	Recommendation of the Committee.	Action taken
1	Page 2. (Item No. 1 of Agenda)	The careful study of the existing data and the correlation of the results hitherto obtained from field trials of (a) farm-yard manure, (b) green manure, (c) oil cakes, (d) bone-meal, (e) fish manure and (f) Indian saltpetre.	(1) The Imperial Council of Agricultural Research should give a small grant for three months to each province without exception, for extra staff to assist in this work. (2) that the grants should be for the salary of one Agricultural Officer on Rs 250 for three months and for one Statistical Assistant on Rs 200 for three months making a total contribution to each province of Rs. 1,050	Local Governments addressed on the matter with the sanction of the Governing Body. Most of the Governments have agreed.
2	Page 8 (Item No. 2 of Agenda)	The means by which the above manures may be conserved.	That the provincial representatives on the Committee should write notes on the methods by which in their opinion, the oil-crushing industry in India could be encouraged for the consideration of the oil seed crushing Committee.	Members of the Fertilisers Committee addressed in the matter.
3	Page 10. (Item No. 2 of Agenda)	(d) Bone meal ..	The possibility of easily disintegrating bone by previous fermentation should be investigated before the next meeting of the Committee.	The members who undertook to carry out the necessary experiments are carrying out the required action in the matter.
4	Ditto ..	Ditto ..	The Committee, while provisionally of the opinion that an all-India Fertilisers Act was necessary, recommended that, between now and its next meeting when the question would be further considered, provinces should examine the necessity for an all-India Act.	Members of the Committee requested to forward their views and any definite evidence that they may have for such an act.
5	Pages 10—11. (Item No. 2 of Agenda).	(e) Fish-manure ..	Enquiries should be made between now and the next meeting from the Director of Fisheries, Madras, and the authorities concerned in Bombay, Bengal and Burma as to the existing condition of the fishing industry in those provinces and as to its possibilities of development in so far as supplies of fish manure were concerned.	Enquiries made; and some replies received.
6	Page 11. (Item No. 2 of Agenda)	(f) Indian Saltpetre	Indian Saltpetre was not important from an indigenous mineral point of view.	No action.
7	Page 12	Night soil ..	Though there might be nothing in these beliefs held by some people that manuring with poudrette spread disease, it might be just as well to get the opinion of some public health authority on this point; e.g. whether the use of poudrette as manure had any relation to the spread of hookworm	The Public Health Commissioner to the Government of India has been addressed.

Statement showing the recommendations made in the Proceedings of the first meeting of the Fertilisers Committee held in June 1930, and the action taken thereon—contd.

No.	Page No. of Proceedings and item No. of Agenda.	Subject.	Recommendation of the Committee.	Action taken.
8	Page 15 (Item No. 3 of Agenda.)	The means by which indigenous manures may be cheapened and their use extended.	(1) That the Provincial Departments of Industries should provide financial and technical assistance to individuals and co-operative societies requiring it for starting bone-crushing factories; the amount borrowed would be repaid by the party concerned to the Local Government under the terms of the State-Aid to Industries Act. In this connection, the attention of Local Governments should be drawn to the example set by the Government of the United Provinces, of making small grants for the erection of bone-crushing factories. This recommendation applied to all the Phosphate deficient tracts in India such as far as the Committee's present information went were Madras, Bombay, the United Provinces, Bihar and Orissa and Assam or those where bone-meal had proved to be an economic failure. (2) That the Council should offer a prize of Rs. 3500 in each case for a bone crusher worked (a) by bullock power and (b) by engine power. On Mr. Burt's suggestion, certain general conditions were agreed to so far as (b) was concerned. The Committee laid down no conditions at this stage for the prize for a crusher worked by bullock power.	This is for the consideration of the Advisory Board. Sanctioned
9	Page 16. (Item No. 3 of Agenda.)	Fish-manure ..	The Committee asked Mr. Sethi and Rai Bahadur Viswanath to investigate the possibilities of establishing a fish guano industry on the Chilka Lake and to report to the next meeting. The newly appointed Agricultural Officer, Band, to be requested to investigate the possibilities for such an industry at Karachi.	They have been requested to take necessary action.
10	Pages 16—17. (Item No. 4 of Agenda.)	Further research in regard to the possibilities of indigenous manures, especially in unirrigated tracts and in tracts with defective irrigation facilities.	(1) The Committee agreed to certain general principles which in its opinion should govern the planning of such experiments. (2) The Committee agreed that research into plant metabolism was of value and should be encouraged. (3) The Committee felt that it was the proper function of the Council, through scholarships and grants to Universities, to encourage research into the question of the rejuvenation of the soil in India.	This is for the consideration of the Advisory Board.

APPENDIX XXXIV.

PRELIMINARY REPORT BY THE FOREST RESEARCH INSTITUTE,
DEHRA DUN, ON THE CALORIFIC VALUES OF SOME INDIAN
WOODS.

The attached copy of a preliminary report (Annexure I) received from the Forest Research Institute, Dehra Dun, on the calorific value of some Indian woods and of a note (Annexure II) by the Agricultural Expert Adviser to the Council are submitted for the consideration of the Advisory Board.

M. S. A. HYDARI,

Secretary.

The 7th October 1930.

ANNEXURE I.

THE DETERMINATION OF THE CALORIFIC VALUES OF INDIAN WOODS.

Perusal of the literature shows that the only record of the Calorific values of Indian woods is that by Dr. Leather* who in 1894-96 determined, for some 22 woods, the heat values in terms of evaporative power. The evaporative power being the number of pounds of water at 212° F. that can be evaporated or converted into steam by one pound of the wood. Mr. Puran Singh (Forest Bulletin No. 1, 1911) redetermined the Calorific values of some of the woods in Dr. Leather's list, and brought them in line with the results of his own experiments, expressing the values in Calories and the British Thermal Units. These determinations were carried out in Lewis Thompson's Calorimeter, an apparatus of not very great accuracy and, hence the results that were found are not in agreement with the values now obtained, using the latest type of Calorimeter.

The previous workers made the determinations on an average sample of wood and did not take into account the variation in the Calorific power caused by—

- (a) the difference in the values of heartwood and the sapwood, and
- (b) the presence of volatiles and resins;

It was, therefore, considered necessary to redetermine the Calorific values of the Indian woods using the latest type of Calorimeter. The experiments described in this note, have been made with the Parr Standard Calorimeter, supplied by the Standard Calorimeter Company, East Moline, Illinois, U. S. A., using the standard chemicals for combustion, as recommended by the manufacturers. In experiments with Calorimeters of this type, an accuracy of the temperature reading to a second place of decimal is regarded as sufficient and this affects the final results by 31 Calories. The variation in the final result due to ash determination amounts to about 8 Calories for an error of 1 per cent. and, a slightly higher variation may be accounted for errors in moisture determination. In the final figures an error, therefore, of ± 50 Calories is reasonably permissible and this represents, in an average Calorific value of 5,000 Calories an experimental error of one per cent.

The usual practice in determinations of this sort is, to select a piece of wood containing both the heartwood and the sapwood and, after drying it in the powdered form to determine its Calorific value. In this it is presumed that there is no difference in the Calorific value of the heartwood and the sapwood and, that the proportion of the heartwood and the sapwood is about the same in all cases, thus representing an average sample of the wood. In order to verify these assumptions preliminary experiments were performed on the heartwood and the sapwood of a few species, chosen at random. Preliminary experiments showed that the difference in the Calorific values between the sapwood and the heartwood varies from a minimum of Zero, in many cases to 525 Cal. in *Sterculia urens* and 598 in *Tectona grandis*. These differences are too high to be neglected. The following table shows the difference in the Calorific values of the heartwood and sapwood of some of the species :—

Species.	Heartwood (calories).	Sapwood (calories).	Difference (calories).
<i>Tectona grandis</i>	5,468	4,870	598
<i>Sterculia urens</i>	5,051	5,126	525
<i>Cedrus Deodara</i>	5,478	5,033	425
<i>Shorea robusta</i>	5,395	5,071	324
<i>Ougeinia dalbergioides</i>	5,090	4,778	312
<i>Dalbergia Sissoo</i>	5,056	4,775	281
<i>Morus alba</i>	4,887	4,600	267

* Appendix.

The difference in the calorific value of the heartwood and the sapwood may be due to a variety of causes. One such cause that has been detected in some cases is the concentration of resins and volatile in the heartwood. For example, *Cedrus Deodora* is well known to possess volatile aromatic substances which are removed by heating the wood to about 105° C. Experiments have shown that the concentration of such volatile is greater in the heartwood than in the sapwood. If, therefore, the calorific value of cedar is determined when it is air dried, the heat value is found to be very much higher when calculated on a no-moisture basis than the heat value of the vacuum dried wood. Also the value for the sapwood is much lower than that for the heartwood, as shown in the following table :-

<i>Cedrus Deodora.</i>	Sapwood (calories).	Heartwood (calories).
Calorific value of an air dried sample calculated on zero moisture basis.	5,023	5,475
Calorific value for vacuum dried sample	5,102	5,132

It is clear from the above results that the difference in the values for the heartwood and the sapwood is primarily due to the volatile concentration in the former and, that by heat and evaporation these lost give a concentrate air removed. The calorific value for *Cedrus Deodora* should, therefore, be taken as the latter figure of 5,132. A more remarkable case is that of *Taxus americana* where the difference in the heartwood and the sapwood is as high as 50% and this is again due to the presence of large quantities of oil in the heartwood. The oil, however, is not lost in the case of *Cedrus Deodora* by heating at 105°, but is removed only by boiling in suitable solvents. The results obtained in this manner are set out below :-

<i>Taxus americana.</i>	Heartwood calories.
Calorific value of the vacuum dried wood	5,468
Calorific value of the above after boiling in petroleum ether for 24 hours.	5,282

As a rule, heartwoods in most of the species show higher heat values than the sapwoods but there are certain species in which the heartwood shows a lower value than the sapwood. The reason for such an observability is not apparent and this point is being further investigated. The following table shows the species in which the heartwood has a lower calorific value than the sapwood :-

Species.	Heartwood (calories)	Sapwood (calories).
<i>Amorpha latifolia</i>	4,350	4,761
<i>Quercus alba</i>	5,082	5,245
<i>Juniperus procumbens</i>	4,797	4,896

In case of such woods that do not possess any visible heartwood, only one determination has necessarily been made. The following is the list of such species that have been found in our work, so far. These species were obtained from the Divisional Forest Officer, Dehra Dun :—

Kydia calycina.

Adina cordifolia.

Mallotus philippinensis.

Celtis australis.

Bombax malabaricum.

Terminalia belerica.

Bauhinia variegata.

Zizyphus xylopyra.

Grewia vestita.

Butea frondosa.

Capparis aphylla.

Rhododendron arboreum.

Abies Webbiana.

For purposes of uniformity determinations of the heat values in all cases have been made on materials dried in air oven at 105°C. and keeping in vacuum desiccator to zero moisture, but in certain cases (especially in those containing volatiles) this would not appear to be the best course, as there would be a danger of losing all the volatiles and, hence the combustible materials and, thereby lowering the calorific values. Experiments were, therefore, performed on some of the woods containing volatiles to see if any appreciable loss in the amounts of the volatiles is caused when an air dried powder of such a wood is dried further in hot air ovens and desiccators. The calorific value of a sample of air dried powder of *Pinus longifolia* was determined and a portion of the same sample was heated to 105°C. in an air oven till no loss in weight was observed and, was further kept in an evacuated desiccator over strong sulphuric acid for 48 hours and the calorific value determined again. The following results were obtained :—

Calorific value of the air dried wood powder .. = 5,042 Cal.

The above wood powder was found to contain moisture = 6.26 per cent.

∴ The Calorific value for the vacuum dried wood as calculated from the above results

$$= 5,042 \times \frac{100}{100 - 6.26} \text{ or } = 5,379 \text{ Cal.}$$

Calorific value of the vacuum dried wood powder .. = 5,340 Cal.

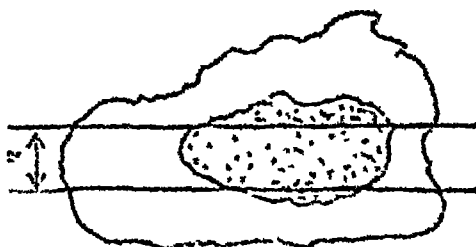
The above results indicate that there is practically no loss of the heat power of the *Pinus longifolia* wood when heated to a temperature of 105°C., in other words, there is no loss of the volatile constituents of the wood on drying from the air dried stage to the vacuum dried stage. These results are in agreement with the results obtained by Parr and Davidson (Journ. Ind. and Eng. Chem. Vol. 14, No. 10, page 935), who found that in pine wood even at a temperature of 135—140°C., the loss of the volatile constituents other than water was about 0.3 per cent. and that it may be considered as negligible at a temperature of 105°C. But these remarks are not applicable to all the cases, as has already been shown in the case of *Cedrus Deodara* that almost whole of the volatiles are lost when the wood powder is heated to 105°C. in an air oven and later dried in a vacuum desiccator. For woods which are known to possess volatile matters, determinations have

therefore been made on the air dried material and, for the purpose of comparison have been calculated on zero moisture basis. In the case of *Pinus taeda* difference in the calorific value in the samples obtained from different sources is found to be due to different concentrations of various materials in the wood. In order to make certainty of the point, a sample of *Pinus taeda* wood known to be highly saturated with chlorides was presented from West Alberta and the heat value of the sample was found to be very much higher than the heat values of an average sample of that Wood. The following table gives the calorific values of Chlor Wood obtained from different sources:—

Locality from which the sample was obtained.	Calorific value (calories).	Remarks.
Rainforest	5,370	Sapwood.
Dead Tree	{ 4,945 5,040	Sapwood. Heartwood
West Alberta	6,125	Chuks (wood highly saturated with salts)

Experiment I.

Preparation of the Sample—Properly identified and a perfectly sound specimen of wood about six inches thick is taken and after removal of the bark,



a central portion about 2 in wide is cut off, as shown in the figure. From this portion, sapwood from either side of the heartwood is carefully separated and both the heartwood and the sapwood are then carefully reduced to a coarse powder separated with a clean file. The coarse powder is then spread out, for several hours, for air drying, after which a 20 gram portion of it is reduced further to a very fine powder by grinding, in order to make it pass

through a 100 mesh sieve. The powder obtained is this morning kept in well stoppered bottles for further work.

Moisture Determination—The purpose of the determination of the amount of moisture present in wood cannot be overemphasized in calorimetric work, as the latter is of very little value without the latter. Woods contain varying amounts of water according to the length of time they have been exposed to air after felling and, even when they are allowed to remain exposed to air long enough to attain a state of equilibrium, one specimen could still contain more water than the others, even under identical conditions. For accurate work, it is necessary, however, that the water should be removed as completely as possible and this is accomplished by heating the air dried wood powder in an air oven at 105°C., for about 10 hours and, allowing it to cool in an evacuated desiccator over concentrated sulphuric acid for a further period of about 18 hours. Loss in weight during these operations is,

therefore, mainly due to water and the moisture content is then calculated on the air dry wood. The variation of moisture has been found to be from 4.67—20.83 per cent. Very faulty results may be obtained by incomplete removal of the moisture as the moisture contained in wood reduces its heat producing power not only by replacing combustible material, but by absorbing part of the heat produced for its own vapourisation. The following example will make the point clear. Supposing, the wood containing 20 per cent. of moisture had a calorific value of 4,000, then the calorific value of the dried wood, i.e., the one containing zero moisture would be $4,000 \times \frac{100}{100-20} = 5,000$ or 25 per cent. higher than for the moist wood. It is, therefore, apparent that wood intended for fuel should be as dry as possible.

Ash determination.—The ash content of wood is determined by weighing the quantity of ash left behind on complete combustion of a weighed quantity of the finely powdered vacuum dried wood. The ash percentage in normal cases is found to be between 1 to 4 per cent. but in certain woods it is considerably higher, e.g., the heartwood of *Anogeissus latifolia* found to contain 11 per cent. of ash. The ash content of woods is a fairly variable factor being different in trees of the same species obtained from different localities depending on the soil and the climatic conditions. But the actual heat value of the wood is not affected very greatly by the ash variation, the calorific value being 8 Cal. per 1 per cent. difference in ash.

Calorimeter and the Temperature reading.—Parr's Standard Calorimeter consists of a polished nickel plated copper jar of about 2 litres capacity placed inside a well insulated jacket. Into the jar is placed a fusion cup which holds the material (0.5 gr.) to be combusted together with the oxygen producing material (sodium peroxide) and the accelerator potassium chlorate (1 gram). The cap of the fusion cup has an arrangement for holding ignition wire, which when electrically connected, fuses (requires 2 amp. current) and starts the combustion of the materials in the fusion cup. The fusion cup is thoroughly water proof and has on its outside an arrangement for fixing two blades which act as stirrers, when the fusion cup is revolved inside the jar by a pulley and a small motor and in this manner a uniform temperature is maintained. Into the jar is poured exactly 2 litres of distilled water. In order to avoid the radiation correction, the water is kept as many degrees below the room temperature as the final temperature after ignition is expected to rise. Perfectly dry materials are employed for determinations of calorific values. The heat given out on combustion of the materials inside the fusion cup is absorbed by the cold water, the rise in temperature of which is noted very carefully. The temperature of the water is taken every minute for 5 mts. before ignition and the temperature record is continued to be taken at one minute interval, for about 10 or 12 mts. after ignition. The following example illustrates the actual method of determination of the calorific values :—

Specimen G. 160. Dalbergia Sissoo (heartwood)—

Weight of the vacuum dried wood powder ..	..	= 0.500 gr.
Weight of the accelerator ..	..	= 1.00 gr.
Ash content of the wood ..	..	= 2.40 per cent.

Readings :—

Time in mts.	Temperature of water in degrees Centigrade.
After 1 ..	25.00
2 ..	25.00
3 ..	25.00
4 ..	25.00

L92810AR

5	..	..	..	..	25.90	
6	..	..	..	..	25.90	Bred at this stage,
7	..	..	..	..	26.80	
8	..	..	..	..	27.44	
9	..	..	..	..	27.62	
10	..	..	..	..	27.70	
11	..	..	..	..	27.76	
12	..	..	..	..	27.78	maximum reached.
13	..	..	..	..	27.78	
14	..	..	..	..	27.78	
15	..	..	..	..	27.78	
16	..	..	..	..	27.78	
Room temperature ..					26.80	
Initial temperature of water ..					25.90	
Final temperature of water ..					27.78	

Correction factors :—

Since the initial temperature of water is about as much below the room temperature as the final temperature is above it, therefore the correction for the heat lost by radiation is practically Zero.

Heat absorbed by water, liberated on ignition of the fuse wire ..	..	= 0.0030°C.
Heat due to ash ..	..	= 0.0025°C. $\times 2.40 = 0.0060$
Heat due to 1 gram of Accelerator ..	..	= 0.1500°C.

Total heat correction ..	..	= 0.1590°C.
Rise in temperature of water ..	..	= 1.7940°C.
Less total heat correction ..	..	= 0.1590°C.
\therefore Corrected rise ..	..	= 1.6310°C.

The constant for the Calorimeter as given by the makers, tested and found correct 3,100.

\therefore The Calorific value = $3,100 \times 1.6310 = 5,056$ Calories.

The factor 3,100 has been deduced by the manufacturer as follows :—

"The water used plus the water equivalent of the metal in the instrument amounts to 2,123.3 gr. In the reaction 73 per cent. of the heat is due to combustion of coal and 27 per cent. is due to the heat of combination of Co and water with the chemicals. If now 0.50 gr. of coal causes 2,123.3 gr. of water to rise 'r' degrees and if only 73 per

cent. of this is due to combustion then $0.73 \times 2123.3 \times 2 \times 'r' =$ rise in temperature which would result from combustion of an equal weight (2,123.3 gr.) of coal $= 3,100$. The factor 2 is used instead of the divisor 0.5, the weight of coal taken. If the thermometer used is graduated in the Fahrenheit scale, then obviously multiplying by the factor 3,100 will give the results in British Thermal Units (B. T. U.). If, however, the thermometer used is graduated in the Centigrade scale, then the product derived by the use of the factor 3,100 will give the results in Calories."

In the table of results, the Calorific power is given both in Calories as well as in B. T. U.

One Calorie is the amount of heat required to raise the temperature of 1 gram of water by one degree Centigrade.

One B. T. U. is the amount of heat required to raise the temperature of one pound of pure water by one degree Fahrenheit.

APPENDIX.

Name of species.	Evaporative power
<i>Acacia arabica</i> (3 samples from different localities)	6.02—8.88
<i>Acacia Catechu</i> (13 samples from different localities)	7.86—9.00
<i>Albizzia amara</i>	8.88
<i>Anogeissus latifolia</i> (3 samples from different localities)	7.65—9.01
Bamboos (3 samples from different localities)	7.65—8.68
<i>Boswellia serrata</i>	8.27
<i>Dillenia pentagyna</i> (3 samples from different localities)	8.18—9.20
<i>Diospyros Melanoxyton</i>	7.45
<i>Dipterocarpus tuberculatus</i> (4 samples from different localities)	8.47—8.68
<i>Eucalyptus Globulus</i>	8.47
<i>Eugenia Jambolana</i> (6 samples from different localities)	8.16—8.79
<i>Lagerstroemia parviflora</i> (3 samples from different localities)	8.06—8.88
<i>Lebedieropsis orbicularis</i>	7.86
<i>Phyllanthus Embica</i>	8.27
<i>Pinus excelsa</i>	9.20
<i>Quercus dilatata</i>	8.27
<i>Quercus lamellosa</i>	7.97
<i>Shorea robusta</i> (9 samples from different localities)	8.38—9.09
<i>Soyimida febrifuga</i>	7.86
<i>Tamarindus indica</i> (3 samples from different localities)	8.06—8.34
<i>Terminalia tomentosa</i> (11 samples from different localities)	7.15—9.00
<i>Xylia dolabriformis</i> (7 samples from different localities)	8.06—9.20

ANNEXURE II.

NOTE DATED THE 1st OCTOBER 1930, BY THE AGRICULTURAL EXPERT TO THE
IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

These results promise to be useful. What we really want to know is the full value of the wood, in its usual air-dry state, i.e., as sold for fuel, per maund or per ton so that we can compare it with coal or coaldung cakes. It would be an advantage, therefore, if the Calorific value on the "air-dry" basis were given, as well as for "vacuum dry", when the results are published.

2. In regard to the species studied one would like to see "Bahul" (*Acacia Arabica*) included and any other species which are successful in reclamation forests like those in Etawah, United Provinces.

3. We should be interested to know whether tests other than Calorific value are being made, e.g., general suitability for fuel purposes, amount of smoke, odour, etc.

Butea frondosa, for example, is a wood with fairly high Calorific value and grows well on waste lands but is an unpopular fuel because of its smell.

APPENDIX XXXV.

ARRANGEMENTS FOR THE EXAMINATION OF PAPERS FOR THE
NEW JOURNALS BY SPECIALISTS AND THE PREPARATION OF
A LIST OF SUCH REFEREES.

Attention is invited to the enclosed extract from the proceedings of the Editorial Committee of the publications issued by the Imperial Council of Agricultural Research, held on the 1st September 1930, in which the Committee suggested a procedure for the examination of papers for the new Journals and the preparation of a list of such referees. As members of the Advisory Board might like to comment thereon this recommendation of the Editorial Committee is submitted to the Advisory Board for consideration. None of the proposed referees have yet been invited to serve.

M S. A. HYDARI,

Secretary.

The 10th December 1930.

Extract from the proceedings of the Editorial Committee, held on the 1st September 1930.

Arrangements for the examination of papers by specialists and the preparation of a list of such referees.—In the past Pusa memoranda and Pusa Bulletins have all been examined by the Pusa Council and the Agricultural Adviser also possessed powers to refer any paper to an outside expert for opinion; at times this power has been used fairly freely. It was agreed that it was essential to have a number of specialists to assist the Editorial Committee in dealing with papers submitted for publication.

The procedure suggested is that on receipt of a paper it should be seen by the appropriate expert of the Imperial Council and then referred to one or more of the specialist referees. On return from the latter, if there is any doubt about the suitability of the paper or as to changes which are necessary in it, the paper should be referred to the three members of the Editorial Committee for Crops and Soils or for Animal Husbandry as the case may be. If there is no doubt as to the suitability of the paper it can be published without delay; in some cases it will not even be necessary to refer a paper to a specialist referee. In some cases it will be necessary for the specialist referee to suggest modifications in the paper. Past experience shows that it has sometimes been necessary to have the English revised, diagrams modified, number of plates reduced, etc.; these are matters for the Publication Section mainly. It is suggested that the Editorial Committee should always meet in conjunction with the meetings of the Advisory Board, either before or after as may be convenient, to deal with any matters of general importance. This course would be particularly useful during the first year of the new journals. Otherwise business will of course be carried out by circulation.

The following referees are proposed for the different branches; it may be necessary to add to this number from time to time.

<i>General Agriculture</i> ..	.. Mr. G. S. Henderson, Director of Agriculture, Bihar and Orissa Mr. T. D. Stock, Deputy Director of Agriculture, Burma. (At present officiating Director.) Dr. A. E. Parr, Deputy Director of Agriculture, United Provinces. Mr. Wilson, Director of Agriculture, Madras.
<i>Plant and Soil Bio-chemistry</i> ..	.. The Professor of Bio-chemistry at the Indian Institute of Science. Mr. B. Viswanath, Madras. Mrs. Norris, Lac Research Institute.
<i>Physical Chemistry</i> ..	.. Professor Bhatnagar, Lahore. Professor Ghosh, Dacca. Mr. Charlton, Burma. Dr. Carpenter, Indian Tea Association.
<i>Agricultural Bacteriology</i> ..	.. Mr. Walton. Mr. Charlton. Dr. Harrison, a member of the Editorial Committee, will also act as referee for papers in the last three groups.
<i>Botany-Genetics</i> ..	.. Dr. Shaw. Dr. Hector. Mr. Mahta, Central Provinces.

<i>History—General and Systematic—and Horticulture.</i>	..	..	Professor Aglukar (Member of the Editorial Committee).
			Mr. Milne.
			Mr. Burns.
<i>Plant Physiology</i>	..	..	Professor Parija.
			Professor Ekambaram.
<i>Mycology</i>	..	..	Dr. McRae
			Mr. Rhind, Burma.
			Dr. K. C. Mehta.
			Mr. Sundararaman.
			Professor Ajrekar, Ahmedabad.
<i>Entomology</i>	..	..	Mr. T. Bainbrigge Fletcher.
			Mr. Richards.
			Mr. Ramchandra Rao.
			Dr. Chopra (of the Indian Museum).
<i>Agricultural Engineering</i>	..	..	Mr. Brownlie.
			(Others to be added as necessity arises.)
<i>Veterinary Science and Animal Husbandry—</i>			
<i>Veterinary Surgery</i>	..	..	Mr. A. D. McGregor.
			Mr. Ulric Walker.
<i>Veterinary Medicine</i>	..	..	Mr. Hewlett.
			Mr. Taylor.
<i>Veterinary Pathology and Bacteriology</i>	..	..	Mr. Cooper (Muktesar).
			Mr. Krishnamurti Iyer (Madras).
			Mr. Shirlaw, Punjab.
<i>Proto-Zoology</i>	..	..	Col. Knowles, Calcutta School of Tropical Medicine.
			Mr. Mitchell, Burma.
			The Protozoologist, Muktesar (when appointed).
<i>Virus diseases</i>	..	..	} Mr. Maddow.
<i>Serum preparation</i>	..	..
<i>Helminthology</i>	..	..	Mr. Wate
			Dr. Maplesstone (Calcutta School of Tropical Medicine).
			Mr. Bhalerau, Muktesar.
			Mr. Anantananyana Rao, Madras.
<i>Veterinary Entomology</i>	..	..	Mr. Malkhuti.
			(Mr. Fletcher for systematics when necessary.)
<i>Mycotic diseases</i>	..	..	Dr. Acton (Calcutta School of Tropical Medicine).
<i>Animal Bio-chemistry</i>	..	..	Mr. Warth.
			Dr. Landen.
<i>Animal Genetics</i>	..	..	Col. Malson.
			Mr. C. H. Parr (United Provinces).
			Mr. Littlewood, Madras.
INSECTARIA			

APPENDIX XXXVI.

WORLD'S GRAIN EXHIBITION AND CONFERENCE, CANADA, 1932.

The question of the participation of India in the World's Grain Exhibition and Conference, Canada, 1932, was considered by the Advisory Board at its meeting held at Simla in June 1930. The Advisory Board recommended that exhibits illustrating cereal products (for example, specimens of pedigree strains of wheat, rice and barley) should be sent to the Exhibition, that arrangements should be made for papers on the improvements effected in Indian cereal crops being circulated at the Exhibition, and that a delegate should be sent to the Conference who, in his turn, would obtain information for subsequent diffusion in India. The recommendation of the Advisory Board was accepted by the Governing Body in July 1930 and necessary arrangements for the supply of exhibits and papers are being made with the Provincial Agricultural Department, etc. In the meantime, the attached extracts from the "Announcement and Prize List" dealing with the Conference are submitted for the information of the Advisory Board. It is for consideration on what subjects papers should be sent from India to the Conference and what authors should be invited by the Council to contribute papers.

M. S. A. HYDARI,

Secretary.

The 2nd December 1930.

Extracts from the "Announcement and Price List".

It is the wish of the World's Grain Exhibition and Conference Executive to make the Conference representative of the World's best thought along practical and scientific lines, and to secure outstanding contributors from all countries whose experts are recognized as leaders in their particular lines. It amounts really to the organizing of a conference, that will constitute a clearing house for world thought and knowledge on every important branch of field crop production and marketing.

SESSIONS AND PAPERS.

Sessions.—For purposes of discussion relative to special branches the Conference will be divided into Sessions at the discretion of the Executive. These sessions will run simultaneously. Each Session will have a Chairman, Vice-Chairman and Secretary appointed by the Executive Committee.

Official Languages.—The official languages will be English and French. Provision will be made for translators.

Papers.—Papers will be classified in sections as follows:—

(a) Agronomy—

Soils including physics, chemistry and bacteriology.
Cultural Problems and Methods.
Fertilizers.
Weeds
Plant Breeding and Genetics.
Diseases of Plants.
Experimental Methods (plot work).
Seed production and registration.
Irrigation.

*(b) Insect Pests and Fumigants.**(c) Economics, including marketing—*

Farm management and costs.
Grading.
Merchandising and Financing.
Storage and transportation.
World markets

*(d) Milling and Baking.**(e) Agricultural Machinery—*

Seed Cleaning.
Cultural.
Harvesting.

(f) General.

Contributors.—It is desired by the Executive Committee to have papers submitted by the best authorities available in the various participating countries. National Committees are asked to submit to the Executive proposals for the presentation of these papers. These proposals should include—

*(a) Name of author.**(b) Subject of paper.**(c) Brief indication of the scope of the paper.*

Acceptance of papers.—The decision as to suitability of papers will rest with the Executive Committee. Upon receipt of the information requested in the preceding paragraph, the Executive Committee will indicate without delay whether the papers can be accepted for presentation.

Length of papers.—The average length of papers should not exceed 2,000 words.

Illustrations.—The Executive Committee will endeavour to publish such illustrations as may accompany papers.

Résumés of papers.—It is contemplated that brief résumés of all papers will be printed in English and French and circulated to delegates in advance of the commencing of the Sessions.

Latest date for submitting papers.—All papers must be in the hands of the Executive Committee not later than January 1st, 1932. Papers received after that date cannot be considered.

Time of holding Sessions.—The various Sessions will be held simultaneously in the mornings during the Conference, commencing not later than 9-30 A.M. and adjourning not later than 12-30 P.M.

Reporting Sessions.—Reporters will be in attendance at all Sessions in order that important points brought out in discussion may be recorded.

Scientific Conference.—Should it be deemed advisable to hold a short series of purely scientific conferences, the necessary arrangements will be made for these by the Executive Committee. In the event of such conferences being held they will be arranged so that they do not conflict with the regular Sessions.

Slides and Motion Picture.—Certain of the lecture halls will be fitted with screens and lanterns for the showing of motion pictures and slides. When slides or motion pictures are to be used in connection with papers, the fact should be noted when the papers are submitted.

Report of proceedings.—The Executive Committee will print a report of the Conference proceedings. This will include the papers presented at the Sessions, and the main points brought out in the discussions. It will be impossible to print discussions in full.

Papers and Publicity.—Contributors of papers are requested to refrain from the distribution of copies for publicity purposes, pending the publishing of the "Report of Proceedings".

Separates.—Special arrangements will be made with the publishers of the "Report of the Conference Proceedings" for the printing of "Separates" of the papers appearing in the Report. The cost of these and further necessary particulars will be available later.

Changes to programme.—The Executive Committee may, on occasion, make such changes to the official programme as may be deemed necessary.

Matters not covered by regulation.—Any matters not covered by the foregoing regulations will be decided by the Executive Committee.

CANADA AND AGRICULTURE.

Agriculture is Canada's basic industry, and the opportunities for greater agricultural development are almost unlimited. The total land area of Canada is some 1,401,318,388 acres, and of this vast expanse 358,162,100 acres are available for agricultural use. The last census statistics give 140,887,903 acres as the occupied farm land in 1921, which is only 30.3 per cent. of the land available for agricultural production.

In 1928 the area under cultivation amounted to nearly 150,000,000 acres, and the previous year the live stock totalled 3,421,857 horses, 3,894,311 milch cows, 5,277,927 other cattle, 3,262,706 sheep, 4,694,789 swine and 50,178,485 head of poultry.

Canada's gross agricultural revenue in 1923 amounted to \$1,397,085,000 and in 1928 to \$1,730,304,000, an increase of 23.85 per cent. The gross agricultural wealth in 1923 amounted to \$7,420,410,000 and in 1928 to \$8,027,301,000, an increase of 8.17 per cent.

APPENDIX XXXVII.

OFFICE MEMORANDUM No. 2026-G, DATED NEW DELHI, THE 1ST DECEMBER 1930,
FROM THE GOVERNMENT OF INDIA, DEPARTMENT OF COMMERCE, TO THE
SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

SUBJECT.—*Revision of the publications "Dictionary of the Economic Products of India" and "The Commercial Products of India".*

The undersigned is directed to address the Imperial Council of Agricultural Research on the question whether the two publications mentioned above should be revised and republished.

2 The "Dictionary of the Economic Products of India", which consists of nine volumes and was completed in about nine years, has long been out of print and unprocureable. The question of revising the Dictionary was considered by the Government of India in 1907 and a copy of an Office Memorandum from the Department of Commerce and Industry, No. 5531-S, dated the 14th July 1906, with its annexure is enclosed, which explains the reasons which were then considered by the Government of India to exist in favour of and against the proposal to prepare and publish a revised edition of the Dictionary. It was eventually decided, with the approval of the Secretary of State, that a general revision of the work should be postponed for several years in view more especially of the fact that scientific enquiry into agricultural and veterinary subjects had only recently been organised on an adequate scale. A subsidiary proposal that, pending a general revision of the Dictionary a revised edition of it should be undertaken at once to include only those minor articles which were not included in an abridgement of the Dictionary which was then about to appear was also dropped. The abridged edition of the Dictionary was published in 1908 by Mr. John Murray under the title "The Commercial Products of India".

3 The preparation of a revised edition of the Dictionary will involve considerable expenditure and a long time in preparation, and this Department is provisionally of opinion that a new edition of "The Commercial Products of India" would render unnecessary a revision of the Dictionary. Before arriving at a final decision in the matter, however, the Commerce Department would be glad to be favoured with the views of the Imperial Council of Agricultural Research on the question whether the "Dictionary of the Economic Products of India" or "The Commercial Products of India" or both should be revised and republished and, if so, regarding the lines on which such revision should be undertaken. The Commerce Department would also be glad of the advice of the Imperial Council of Agricultural Research regarding the plan which should be followed in preparing a revised edition, e.g., whether the continuous alphabetical arrangement should be preserved or whether any new publication should be divided into sections for the various classes of products (mineral, agricultural, manufactures, etc.).

Copy of Office Memorandum No. 5531-S, dated Simla, the 14th July 1906, from the Government of India, Department of Commerce and Industry, to the Department of Revenue and Agriculture, Government of India.

With reference to the correspondence ending with the endorsement from the Department of Revenue and Agriculture, No. 331-84-I., dated the 20th February 1906, the undersigned is directed to request that the opinion of the Board of Scientific Advice may be obtained regarding the revision of the Dictionary of the Economic Products of India. The main issues for decision are three in number :—

- (1) whether a revised edition of the Dictionary should be started at the present time, or whether it should be postponed for a few years ;
- (2) the best plan to adopt for carrying through such a revision ;
- (3) the best scheme of arrangement for the revised edition.

The answer to the first of these questions depends largely on the decision which may be arrived at on the second point, which must therefore be considered first.

2. There would seem to be three possible plans for the preparation of a revised edition of the Dictionary :—

- (a) By a single author who is given the necessary literary assistance, and who may be able to secure the co-operation of a certain number of specialists for writing some articles.
- (b) By the several Departments of Government concerned, under the guidance of an Editor.
- (c) By a special staff consisting of an Editor-in-Chief and Assistant Editors chosen for their knowledge of special branches of the work and their Indian experience (together with literary skill) who would also be able to secure the co-operation of specialists for the preparation of some articles.

A fourth scheme was suggested by Sir W. T. Dyer in 1890, *viz.*, that the work should be revised volume by volume as a part of the regular work of the office of the Reporter on Economic Products. It is thought that this plan is not feasible and may be put aside at once. It would be impossible for the Reporter to undertake this duty in addition to his ordinary work.

3. The first plan is that which was followed in the preparation of the present edition, and it is apparently the course which the authorities of the Indian Office are disposed to approve as the natural method of revision. Sir George Watt who prepared the former edition, and is probably the only man who could be entrusted with revision of the Dictionary on this plan, is available, possesses exceptional qualifications for the task, and is believed to be anxious to undertake the work. On the other hand there are serious objections to this scheme. It is likely to result in a work of very unequal merit, for a single man cannot be competent to deal authoritatively with all the numerous products, and must in many cases be a compiler of material of which he cannot judge the relative value. The present Dictionary, although a remarkable work of great merit, shows this defect very prominently. Moreover, as Sir George Watt will not return to India, the work would have to be carried out in England, probably under the supervision of the authorities at Kew, while the experts whose assistance would be given would for the most part be resident in India. The disadvantages of such an arrangement in preventing personal communication between the Editor and his assistants are obvious, and an Editor in England would find it difficult to exercise the necessary supervision over specialists six thousand miles away. The almost inevitable absence from India for long periods of the Ledger files of the Reporter on Economic Products would be a most serious inconvenience, as has already been found in the case of the Abridgment where great difficulty has also been met with to arrange for the despatch of files at proper intervals so as to admit of their prompt return to India. The delays inherent in this system would also be likely to prevent the completion of the work within a reasonable period. In view of these facts it has been strongly represented that the revision ought to be carried out in this country.

4. The second plan has much to recommend it on the score of cheapness. The Editor would reside in India, and would be responsible only for the general arrangement and literary form of the work. It is feared, however, that it would throw an impossible burden upon some Departments. The present Dictionary fills some 5,200 pages of print which may be taken as the minimum size of the revised work. It is estimated that about two-thirds of the material approximately, would appertain to the Department of Agriculture, and it is understood that the present staff of the Department could not, unless special assistance were given, prepare a revised edition of 3,500 pages of print without neglecting practically all the present work of the Department. The Forest Department would probably be in the same position. The Geological

Department would be in a better position, as it has nearly completed an index and revision of its Manual of Economic Geology, but even so the revision of this material and its preparation in a form suitable for inclusion in the Dictionary might be a task of some magnitude. The other officers most intimately concerned are the Director General of Commercial Intelligence, the Inspector General of the Civil Veterinary Department, the Director of the Botanical Survey, and the Director General of the Indian Medical Service. It has been urged that if the revised edition is to be a real standard reference work of authority, and not merely an ill digested summary of available information, none of these Departments is so strong that it could be expected to undertake such a duty without additional assistance.

5 The third plan, though much the most expensive of the three, is the one which on general grounds appears the most suitable, and the only one by which the work could be completed within a reasonable period from its commencement. A scheme of this nature is almost universally adopted for the preparation of works of this kind. The acceptance of this arrangement, however, involves the postponement of the commencement of the work for some time, and it is therefore next to consider whether the delay can be agreed to.

6 In a Resolution passed on the 31st January 1905 the Advisory Committee of the Royal Society expressed the hope that, as the present edition of the Dictionary was out of print and impracticable, a revised and new edition might be put in hand as soon as practicable. This Resolution was referred by the Secretary of State to the Government of India, who consulted the Board of Scientific Advice. The Board agreed generally with the Committee, but were of opinion that it would be convenient to defer the preparation of the revised edition until the abridgment now under compilation had advanced towards completion. Both the opinions are in favour of the early revision of the Dictionary, and much weight must attach to them; and if it were decided that Sir G. Watt should be asked to undertake the preparation of the new edition, there would be no reason for postponing the start. It must also be

(1) that the present edition is out of print,

(2) that an amount of information has been accumulated quite sufficient to justify its embodiment in a new edition,

(3) that there is a danger that, if the work is postponed too long, the accumulation will tend to become unwieldy and the labour involved in revision greatly increased.

On the other hand it has been suggested that on the part of the Agricultural Department is concerned, it would be much better to postpone the revision for four or five years. The Department is only now being equipped with an adequate staff, and is commencing the systematic investigation of agricultural products. A revision based on the information available at present might be out of date as regards agricultural products in a very few years, and would demand to be revised again. It has also been pointed out that the abridged handbook will to some extent meet the public demand, and obviate the inconvenience of the Dictionary being out of print. Finally it must be said that if either the second or the third plan is adopted, the immediate preparation of the revised Dictionary is an impossibility. When the expert agricultural staff both Imperial and Provincial is complete, and has had time to become familiar with Indian conditions, it should be possible to select men specially fitted for the work and release them of their ordinary duties, but meanwhile their whole energies must be devoted to the ordinary Departmental work.

7. The scheme of arrangement for a revised Dictionary demands consideration. It will have to be decided whether the alphabetical arrangement of the former Dictionary should be adhered to, or whether it should be divided into a number of parts, say, for Animal, Mineral and Vegetable products. It has been

suggested, indeed, that the Dictionary should not be revised in its present form, but that the different Departments should undertake the preparation of suitable manuals or works of reference in respect of the subjects with which they deal. Thus, the Manual of Economic Geology which is nearly complete may contain all the information necessary with regard to minerals. The alphabetical arrangement is undoubtedly the more convenient for purposes of reference and is supported by the high authority of Sir W. T. Dyer, a copy of whose letter, dated the 8th June 1888 is attached to this memorandum for facility of reference. On the other hand the preparation of separate manuals for each Department would prevent the postponement of the whole work until all the Departments were ready to take up the task of revision. It is of course impossible to consider the details of the scheme at present but the general lines of procedure should be laid down.

Copy of letter from Sir W. T. Thiselton-Dyer, to the Under Secretary of State for India, dated Kew, the 8th June 1899.

I have the honour to acknowledge the receipt of Sir Charles Bernard's letter of 7th June (R. and S. 1645), forwarding a copy of a letter from the Government of India relating to the revision of the Dictionary of Economic Products.

It cannot be doubted that in this work India possesses for the first time in an accessible form a digest of the information which has been gradually acquired with regard to its material resources, but which has hitherto been scattered in innumerable publications as well as in official documents and papers not readily available for consultation.

3. The preparation and production of such a work has necessarily not merely stimulated further investigation, but it has revealed points on which further information is needed. The Dictionary, from the nature of things, cannot ever be expected to reach a final form, but from time to time will need bringing up to date. If, however, the office of the Reporter on Economic Products is organized, as it should be, on a permanent basis, the work of successive revision should be neither laborious nor difficult. It appears to me that the time has come when Dr. Watt should be supplied with a younger man as assistant, who may possibly succeed him, or at any rate preserve some continuity in the work. It is obvious that the duties of the Reporter have two sides; on the one hand he is necessarily engaged continuously in the study of Indian Products; on the other in posting up and revising the Dictionary. It is clear that, if single-handed, one or other must from time to time suffer as each in turn becomes the predominant object of his attention. It is further to be feared that, in the event of Dr. Watt's retirement, there would be a deplorable break in continuity with regard to both. But the day has long gone by when India can afford to mark time in anything that relates to her material welfare.

4. The mode in which the revision of the Dictionary should be accomplished is, perhaps, a matter to be most properly settled by the Government of India, after due consideration to local circumstances and conditions, which can hardly be satisfactorily discussed at home. But speaking as one who has the Dictionary in constant use and who feels a deep debt of gratitude for its production, I should deprecate any change in its form. The bibliography should be rather augmented than curtailed, and I attach much importance to the citation of the *ipsissima verba* of the extracts from the authorities quoted. Personally I am in favour of the retention of the exact form of the present work, and I am disposed to support the suggestion that "revision should be continuous and that one volume should always be in hand." It seems to me that this diminishes the formidable aspect of such a task as attempting to recast the whole work and would appreciably diminish the burden of even a more limited revision. Each revised volume would take the place of its predecessor. Sets in office use would remain available for practical purposes of

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consultation and everything accomplished would be so much to the good. Space for the introduction of new matter might be found by the judicious compression of the longer articles on such subjects as tea, which might eventually be made the subject of more copious handbooks. It is not so much for the common and obscure products that the Dictionary is so invaluable as a work of reference.

5. I am most strongly of opinion that a synoptical abridgment in one volume is most desirable. Such an abridgment should be indispensable to every administrative officer who has to deal with agricultural and commercial matters, but whom in a vast number of cases it would be unnecessary to supply with the large edition. Moreover, it could be kept up to date, especially with regard to statistical matter, almost annually. This would save the necessity of a more frequent revision of the larger work.

6. With regard to the Agricultural Ledger Series, I have no doubt that its form has been determined upon after careful consideration of the practical needs of India. I can quite understand that it is convenient to issue from time to time, in the form of a separate pamphlet, information for wide distribution on special subjects. In this respect India follows the example of the United States Government. It cannot be denied that the form of the Agricultural Ledger Series in this respect has its advantages. Many of the articles are, however, very fragmentary, and I doubt the practical advantage of issuing these in a separate form. Personally, I think the Agricultural Ledger Series very trouble-ome to consult. The information contained in it is, therefore, apt to get out of sight. I am disposed to think that the heads of information enumerated in the letter of the Government of India would be much more available for consultation and study if collected in a bi-monthly bulletin or journal. These should, in turn, be collected into annual volumes with a good index. A further collective index might be published quinquennially. I may point out that nearly every Colonial Government now issues an Agricultural Journal, in which such articles as are now comprized in the Agricultural Ledger Series are published collectively, together with briefer notes on matters of general interest, for which at the present time, in the publications of the Government of India, there seems to be no provision. The publication of such a continuous journal would not militate against the separate distribution of special articles.

APPENDIX XXXVIII.

SCHEME FOR THE IMPROVEMENT OF THE CASTOR CROP IN INDIA.

The average acreage under castor in H. E. H. the Nizam's Dominions calculated from the last five years' figures is over 600,000 acres. This is believed to be quite 50 per cent. of the acreage under castor in India and a very large proportion of the castor grown in the world. Hyderabad is, therefore, the most appropriate place to work out the improvement of the castor crop. It has the further advantage of possessing two entirely different classes of soil on which castor is grown, viz., the black cotton soils of the Deccan and the light gravelly soils of the southern peninsula. The great bulk of the commercial crop in Hyderabad is grown on the latter soils in the Telugu district. The output per acre is poor, but little is spent on the crop and it brings in a better return than anything else.

2. In view of the importance of the crop to Hyderabad, the Department of Agriculture has already started work on it, and the Economic Botanist has been engaged on this crop for more than two years. Considerable promise of success has already been obtained. Already some individual plants have been selected which though not yet quite pure for all the desirable characters have nevertheless given a good yield of seed with satisfactory oil content, and it is hoped that within a season or two these can be purified and after multiplication the seed may be distributed to cultivators who thereby will get an yield of at least three to four times their present output. Although this work will be of great use to cultivators in the surrounding provinces where soils are similar to those of Hyderabad, still there are other parts of India such as the Ganga valley where the soil conditions are quite different. Hyderabad would, however, be the best centre in the whole of India for conducting research into this crop, and it will not be difficult to increase the expenditure on the work now in hand to obtain results which would be useful not only to the surrounding provinces but to the whole of the rest of India. It will be necessary first of all to collect as many types of samples of castor as possible from the various parts of British India and also as many of our samples as can be obtained, together with information about the respective conditions of soil, moisture, temperature, manure, trade requirements, etc., and to grow the samples at one of the main farms of the State near Hyderabad. The following breeding and cultural work will also have to be done :—

Breeding.—(1) Isolation and subsequent testing of the unit species from the various varieties of castor grown in India, i.e., isolation of pure lines for all the possible morphological characters and (2) analysis of the factors which make up yield such as the branching habit, the number of male and female flowers in each spike, etc., etc., (3) study of the variation of oil content from plant to plant in the same pure lines, from spike to spike in the same plant and from seed to seed in the same spike in all the different unit species and (4) study of pollination in castor.

General.—(1) Study (largely by pot culture) of the influence of environmental factors, such as soil moisture, manure-nitrogen, phosphorus, air temperature, etc., on the nature of the flowers produced and the yield of seed and oil content obtained; (2) date of sowing trials to determine the best time for sowing and (3) spacing trials to determine the most suitable spacing for different types.

This will mean a grant for additional staff and equipment which it would not be justifiable for the Government of Hyderabad to incur for its own purposes. At present a sum of Rs. 35,935 is being spent annually on the work of the Economic Botanist, apart from the expenditure on a special Cotton Botanist, which is being borne by the Indian Central Cotton Committee. The Economic Botanist has also been provided with the necessary equipment and a laboratory for him is under-

house of construction. If the work is to be expanded so as to place it on an all-India basis, it will be necessary to incur additional expenditure amounting to Rs. 9,350 non recurring and Rs. 15,892 recurring. The latter will be the average expenditure over a period of five years which is the least, for which it will be of any use to undertake these investigations. It is difficult to estimate how much exactly is being spent on the castor crop alone by the Hyderabad Government. The Economic Botanist is now working on four crops, but the castor and paddy crops take up much more of his time than his work on wheat and jowar. In the circumstances, it will no doubt be thought that the State Government is already spending a sufficient amount year by year on this work and that the remainder of the sum now required might be borne by the Research Council. Of the non-recurring expenditure, Rs. 4,760 will be required for equipment and a temporary establishment in accordance with the rules approved by the Governing Body, would be borne by the Research Council and H. E. H. the Nizam's Government will have to be responsible for the balance.

It is hoped that in view of the work which H. E. H.'s Government are already undertaking on this crop which is bound to be beneficial to the surrounding provinces in any case, the Agricultural Research Council will be ready to undertake an average liability of Rs. 15,592 for the next five years as well as to meet non recurring expenditure to the extent of Rs. 4,750.

(Sd) B. A. COLLINS,

Director-General of Commerce and Industry,

H. E. H. the Nizam's Government.

Hyderabad Deccan,

December 7, 1930.

Expenditure in connection with the scheme for the improvement of castor crop in India.

	<i>Non-recurring.</i>	<i>Recurring average of 5 years.</i>
	Rs.	Rs.
I. Capital expenditure—		
(a) Additional laboratory accommodation ..	3,000	
(b) Ideal fencing for 4 acres ..	1,600	
II. Staff—		
(a) Technical assistants. Two for botanical and breeding work each at Rs. 200—20— 300		6,384
(b) Seven plant collectors at Rs. 40—2—50 each		3,048
(c) Clerical staff. One clerk and computer at Rs. 80—5—100		1,140
(d) Menial staff. 2 peons at Rs. 15 each per mensem		360
III. Allowances—		
(a) Travelling allowance		1,200
(b) Conveyance allowance to the staff ..		460
IV. Equipment—		
(a) Apparatus	2,000	
(b) Furniture	1,000	
(c) Typewriter	750	
(d) Shed for pot culture	1,000	
(e). Breeding requirements such as sacking bags, seed bins, etc.		1,200
F. Miscellaneous contingencies		600
G. Extra labour		600
Total ..	9,350	15,802